The Effect of Disability on Subjective Well-Being across the Adult Lifespan: The Moderating Roles of Age at Disability Onset and Disability Type

by

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ABSTRACT

The present study aimed to advance the current understanding of the relation between disability and subjective well-being by examining the extent to which different facets of subjective well-being (life satisfaction, positive affect, and negative affect) change before and after disability onset, and the extent to which age and type of disability moderate such changes. Multiphase growth-curve models to prospective longitudinal survey data from Waves 1-16 of the Household, Income and Labour Dynamics in Australia (HILDA) survey (N = 3,795; mean age = 50.22; age range: 16-99; 51% women). On average, life satisfaction remained relatively stable across the disability transition, whereas positive affect declined and negative affect increased the year surrounding disability onset; in the years thereafter, neither positive affect nor negative affect returned to pre-onset levels. Individuals who acquired disability in old age were more likely to report sustained declines in subjective well-being than were individuals who became disabled in midlife or young adulthood. Psychological disability was associated with the strongest declines across each indicator of subjective well-being at disability onset but also greater adaptation in the years thereafter. The findings provide further evidence against the set-point theory of hedonic adaptation and for a more moderate viewpoint that allows for processes of adaptation to vary based on the outcome examined, the type of stressor, and individual characteristics. The discussion focuses on possible mechanisms underlying the moderating roles of age and type of disability.

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Subjective well-being (SWB) is both an indicator of life adjustment and a predictor of performance across multiple life domains. High SWB is consistently found to be positively associated with later academic and professional success, financial prosperity, healthy interpersonal relationships, and even optimal mental and physical health (Lyubomirsky, King, & Diener, 2005).[1] Conversely, low SWB is reliably found to predict poor outcomes in these life domains (Lyubomirsky et al., 2005). For this reasons, studying subjective well-being—and the factors that influence it—is important not only from a theoretical perspective but also from an applied perspective. Knowledge derived from research on SWB can be used to determine and promote societal health and welfare, either for intrinsic reasons—because societal well-being is valued for its own sake—or for extrinsic reasons, as a means to engender additional positive outcomes, such as economic prosperity (Dolan & Metcalfe, 2012; Kahneman & Krueger, 2006; Layard, 2006; Stiglitz, Sen, & Fitoussi, 2010).

A review of the literature reveals that empirical research on SWB has been vigorously pursued over the last 15 years, despite lingering historical skepticism on the very possibility that SWB is susceptible to change (see Yap, Anusic, & Lucas, 2014, for a discussion of such skepticism). However, this research has been rather limited in scope. Studies have focused on age-related changes in SWB (e.g., Baird, Lucas, & Donnellan, 2010; Cheng, Powdthavee, & Oswald, 2017) or on the impact on SWB of relatively

[1] This association is explained by the fact that high SWB is also consistently shown to engender the characteristics that tend to accompany success, such as productivity and sociability (Lyubomirsky, King, & Diener, 2005).

normative life events, such as marriage, divorce, spousal loss, childbirth, unemployment, retirement, and migration and relocation (Luhmann, Hofman, Eid, & Lucas, 2012). Only a handful of studies has investigated (prospectively) how *disability* affects SWB (e.g., Infurna and Wiest, 2016; Lucas, 2007).

Moreover, such studies have stopped short of examining different dimensions of SWB, focusing on either life satisfaction (the cognitive aspect of SWB) or on psychological distress (a measure of the affective component of SWB), but not on both simultaneously. They have also tended to stop short of examining potential moderators of the relation between disability and SWB; and when they have examined moderators, the focus has been on severity of disability. Thus, very little is known regarding how *age at disability onset* and *type of disability* might attenuate or exacerbate the effect of disability on SWB.

This study addresses these limitations by investigating the relation between disability and subjective well-being across different measures of SWB (i.e., life satisfaction, positive affect, and negative affect) and by examining whether age at disability onset and type of disability have a moderating effect on this relation.

Disability

Definition. Theoretical accounts of disability, such as the Disablement Process Model (Verbrugge & Jette, 1994), define disability as an experience characterized by lasting restrictions or lack of ability to perform activities of daily living due to a physical or mental functional impairment.[2] This is a broad definition that both reflects and has led

[2] This does not imply that conceptual models of disability are necessarily purely medical models. On the contrary, many of them, including the Disablement Process Model, which remains at the forefront of

to an array of operationalizations. Specifically, it is has led to efforts designed, in large part, to remove the ambiguity in the meaning of terms such as "lasting," "restrictions," and "activities of daily living." Indeed, how long should a person experience activity limitations before he or she can be said to have disability? What specific kind and degree of activity limitations should be classified as markers of disability? And what criteria define optimal cutoffs between mild, moderate, and severe disability?

To date, there is no consensus among researchers on some of these (and similar) issues. A review of the empirical literature examining the relation between disability and subjective well-being reveals substantial inconsistency in the way disability is operationally defined. For example, some studies have relied on surveys asking participants whether they have difficulty carrying out Basic and Instrumental Activities of Daily Living (BADLs and IADLs, respectively)—i.e., self-care tasks such as bathing and toileting (BADLs) and routine activities necessary for maintaining a household, such as managing finances and doing house or yard work (IADLs). Other studies have analyzed responses to questionnaires inquiring about participants' ability to perform everyday tasks required of their job (i.e., work-activity limitations). Similarly, some surveys (e.g., the German Socio-Economic Panel) ask participants whether they have been "officially certified" as having a disability, whereas others (e.g., the Household, Income and Labour Dynamics in Australia) ask respondents to report on their disability status based solely on their own assessment.

guiding research on disability (Guralnik & Ferrucci, 2009), do recognize the influence of environmental factors in, if not causing, then certainly alleviating, maintaining, or aggravating disability.

Although the adoption of different operational definitions by different researchers can offer convergent validity to the construct of disability, it can also limit the ability to compare results across studies. Slight variations in the operationalization of disability in survey questions can result in large discrepancies in disability prevalence estimates, which, in turn, can lead to substantial differences in empirical findings and conclusions (see Francescutti, Battisti, Griffo, & Solipaca, 2017, for examples of the impact of different operational definitions of disability on the SWB variability).

Significance of Studying Disability. Although disability is a relatively non-normative life experience, especially among young adults, it affects more than one billion people worldwide (or approximately 15% of the world population), according to the recent *World Report on Disability* jointly produced by the World Health Organization and the World Bank (Officer & Posarac, 2011). Moreover, this percentage has been on the rise and is projected to continue to increase steadily, for two basic reasons. First, the risk and incidence of disability is highest in old age and the world population is aging rapidly. Second, there is a global rise in prevalence of disabling conditions, such as diabetes, cardiovascular disease, cancer, obesity, and mental health disorders (Officer & Posarac, 2011; Seeman, Merkin, Crimmins, & Karlamangla, 2010). Due to advances in medical treatment and the use of assistive technology, the number of people *dying from* such conditions is decreasing compared to the number of people *living with* them. In other words, more people are living longer but with emergent disabilities.

Additionally, research on disability time trends in different types of disability (including limitations in BADLs, IADLs, and mobility- and functional-related activities such as walking, standing, and lifting or carrying weights) does not indicate improvement

over time for most age groups. In fact, with the exception of the oldest-old (aged >80 years), who have shown evidence of declines in mobility- and functional-related activity limitations (e.g., Seeman et al., 2010), no age group has displayed a trend toward less prevalence of various types of disability over the past two decades (Crimmins, 2015). Prevalence of limitations in BADLs and IADLs (as well as in mobility- and functional-related activities for all but the oldest-old) has remained stable for the oldest-old (e.g., Seeman et al., 2010) and even increased—often substantially so—for the younger old (aged 60-79 years) (e.g., Seeman et al., 2010) and for people in midlife (aged 40-59 years) and in young adulthood (aged 18-39 years) (Bhattacharya et al., 2008; Christensen, Doblhammer, Rau, & Vaupel, 2009; Crimmins, 2015; Freedman et al., 2013; Martin & Schoeni, 2014).

Subjective Well-Being

Subjective well-being (SWB) refers broadly to "people's emotional and cognitive evaluations of their life" (Diener, Oishi, & Lucas, 2003). Accordingly, its assessment typically has involved measuring three distinct (but interrelated) constructs: life satisfaction, positive affect, and negative affect. Life satisfaction reflects the cognitive-evaluative component of SWB; it is measured with questions designed to elicit global assessments of one's life in relation to some standard, such as a peer group or one's own envisioned ideal life. Positive affect and negative affect reflect the emotional-evaluative dimension of SWB; they are measured with questions designed to tap into pleasant and unpleasant emotions people experience while carrying out daily activities. To the extent that a person reports high satisfaction with his or her life, a high level of positive affect, and a low level of negative affect, he or she is said to be high in SWB.

Some researchers (e.g., Ryff, 1989, 1995; Ryff & Singer, 2008; Waterman, Schwartz, & Conti, 2008) contend that SWB does not necessarily equate with psychological well-being, arguing that the latter consists of more than just cognitive and affective (or hedonic) elements. Specifically, they conceptualize psychological well-being as including eudaimonic elements, such as self-acceptance and purpose in life, derived from notions of maturity, as Allport intended it, or actualization of one's human potentials, à la Maslow. Nevertheless, SWB is widely considered as a valid (and robust) indicator of life adjustment, as evidenced by the vigor with which it is researched across countries and across disciplines, from psychology to economics to political science to gerontology.

Subjective Well-Being across the Adult Lifespan

Theories of lifespan development, such as the Model of Selective Optimization with Compensation (SOC; Baltes & Baltes, 1990), Heckhausen and Schultz's (1995) lifespan theory of control, and Socioemotional Selectivity Theory (SST; Carstensen, Isaacowitz, & Charles, 1999), suggest that subjective well-being should increase as age increases. For example, the SOC model posits that, at each stage of the lifespan, successful human development depends on maximizing gains and minimizing losses through the orchestrated use of three fundamental sets of self-regulatory strategies: selection, optimization, and compensation. Selection refers to the setting of and commitment to goals, based on personal preferences (elective selection) or in response to perceived loss of internal or contextual resources (loss-based selection). Optimization involves the use of effective means to pursue selected goals. Compensation refers to the use of alternative means to substitute lost means (Baltes & Baltes, 1990).

As individuals age and accumulate life experiences, their knowledge, preference for, and adeptness in the use of these strategies are expected to increasingly grow (Baltes & Baltes, 1990; Freund & Baltes, 2002). [3] Accordingly, the older the individual is, the more likely he/she should be to report high scores in indicators of successful development (or, life adjustment), such as SWB (Freund & Baltes, 2002).

In a similar vein, Socioemotional Selectivity Theory (SST; Carstensen et al., 1999) proposes that, as people age and near death, they become increasingly more aware of their mortality. This increasingly limited time perspective, in turn, causes a motivational shift away from future-oriented goals aimed at expanding horizons and toward present-oriented goals aimed at emotional contentment (Carstensen et al., 1999; Carstensen, 2006). In other words, individuals become less and less interested in pursuing activities that are expected to pay off in the future (e.g., career planning and development of social networks) and increasingly more motivated to prioritize endeavors whose benefits can be realized in the here-and-now and that are emotionally gratifying (e.g., cultivating existing relationships). Accordingly, as age advances, life satisfaction and day-to-day emotional well-being should increase (Charles & Carstensen, 2009).

Lifespan developmental research focusing on changes in life satisfaction, positive affect, and negative affect, however, does not support this contention. Cross-sectional and longitudinal studies alike have shown that life satisfaction and positive affect remain

[3] To be fair, in regards to *late* adulthood, two alternative hypotheses have been formulated (Freund & Baltes, 2002). One, based on the original formulation of the SOC model by Baltes and Baltes (1990), is that older adults continue to become better at the use of SOC strategies, because of accumulated life experiences (Baltes & Baltes, 1990). The second, based on empirical findings that followed Baltes & Baltes (1990), is that the use of SOC strategies may, in fact, decline in late adulthood due to aging-related losses in resources and the related fact that the use of SOC strategies is itself resource-dependent (Freund & Baltes, 2002).

relatively stable through about age 60 and then begin to decline (e.g., Baird et al., 2010; Charles, Reynold, & Gatz, 2001; Gana, Saada, & Amieva, 2015; Kunzmann, 2008; Mroczek & Spiro, 2005). Similarly, negative affect shows reasonable stability throughout early and mid-adulthood followed by progressive increases over time in old age (Hansen, & Slagsvold, 2012; Vogel, Schilling, Wahl, Beekman, & Penninx, 2013). Contrary to the predictions of theoretical models, these results have led researchers to equate advanced age with lessened rather than increased subjective well-being.

That said, research has also revealed substantial differences in levels of, and rate and direction of changes in, SWB among same-age individuals. For example, despite the *average* negative changes in SWB in late life, not all older adults experience increases in negative affect or declines in life satisfaction and positive affect over time (e.g., Charles et al., 2001). Similarly, despite the *average* stability of life satisfaction, positive affect, and negative affect throughout early and mid-adulthood, many young and mid-adults show significant and sustained changes in measures of SWB (e.g., Mroczek & Spiro, 2005).

The existence of such between-person differences suggests that declines in SWB in late life might not be attributable to advanced age. Instead, it is plausible that *non-age-related pathological* processes might be the driving force underlying such declines (Fauth, Gerstorf, Ram, & Malmberg, 2014; Kunzmann, Little, & Smith, 2000). The same processes, such as the disablement process, also might explain differences in SWB among same-age younger adults. For this reason, changes in SWB across the adult lifespan might not be best tracked along a chronological age (i.e., time-from-birth) time

metric, but rather over time metrics that proxy the disablement process, such as a time-to/from-disability onset.

Research Suggesting a Link between Subjective Well-Being and Disability

Theoretical research. Several theories suggest a link between SWB and disability-related processes and events. These include theories of lifespan development, gerontological theories of aging, and theoretical accounts of disability.

Theories of lifespan development. Lifespan developmental psychologists have long regarded the life course as a multidimensional process. For example, Baltes, Reese, and Lipsitt (1980), in their influential tri-factor model, identified three sets of interrelated influences driving development at any given time during the life course: age-related influences, history-related influences, and non-normative influences. Age-related influences are experiences (e.g., puberty, menopause, retirement) that correlate strongly with age and are, therefore, predictable in terms of when they occur and how long they last, at least within the same culture. History-related influences (e.g., wars, epidemics) are associated with a specific time period; they are normative in that they are experienced by the majority of the population during a given time period. Non-normative influences refer to life events (e.g., a lottery win, a car accident, the death of a child) whose occurrence, patterning, and sequencing are unique to a minority of the population. Disability, especially among young adults, falls within the category of non-normative (negative) life events that can (negatively) influence development, and thus affect indicators of (successful) development, such as SWB.

Gerontological theories of aging. Similarly, gerontological theories of aging have long postulated that late life is not a unitary process, driven only by age-related forces;

rather, it is a dynamic combination of both age- and non-age-related processes. As early as 1969, Busse made a conceptual distinction between primary and secondary aging. Primary aging refers to the gradual—and ultimately inevitable—changes (e.g., fading vision, impaired hearing, slowed movements, decreased resistance to infections) that correlate with chronological age and are caused by age-related physical deterioration. Secondary (or atypical, pathological) aging refers to changes caused by illnesses that correlate with age but are preventable, modifiable, and potentially reversible (Busse, 1969). Later, a third distinction was added, termed "tertiary aging," which refers to precipitous changes that occur shortly (months, perhaps years) before death; they are less correlated with age than they are with approaching death (Birren and Cunningham, 1985). Disability-related processes represent the quintessence of secondary aging processes that drive development—thus affecting indicators of life adjustment—in late life.

Theoretical accounts of disability. In a similar vein, theoretical accounts of disability, such as the Disablement Process Model (Verbrugge & Jette, 1994), recognize that disability can have dire consequences for the individual affected, including sustained negative effects on his or her perceived sense of well-being. Specifically, the Disablement Process Model, which remains at the forefront of guiding research on disability (Guralnik & Ferrucci, 2009), conceptualizes disability as the outcome of an inherently dynamic, preventable, modifiable, and potentially reversible process that may be described as a progression from pathology (e.g., arthritis) to impairment (e.g., joint stiffness and pain) to functional limitation (e.g., difficulty bending) and finally disability. Disability refers to experiencing difficulty carrying out activities of daily living (e.g.,

everyday tasks required of one's job, everyday self-care tasks such as bathing and toileting, and routine activities necessary for maintaining a household, such as managing finances and doing house or yard work). Because such activities are essential for independence and social participation, disability acts as a major life stressor and, as such, can have profound negative effects on one's perceived sense of well-being.

Empirical Research. Since Brickman, Coates, and Janoff-Bulman (1978) (in)famously reported finding that paraplegics and quadriplegics are not that much unhappier than lottery winners, there has been an ongoing debate in the disability literature regarding whether and to what extent persons with disability are able to psychologically adapt to their condition. Two main positions have emerged from this debate. One is the position of scholars who fully embrace the counterintuitive idea, put forth by Brickman and colleagues (1978), that people with disability are not nearly as miserable as one might expect—or, that disability does *not* lead to substantial and sustained declines in SWB (e.g., Albrecht & Devlieger, 1999; Amundson, 2010; Riis et al., 2005). These scholars typically emphasize empirical findings showing that many, if not most, people with disability report surprisingly high levels of quality of life and other measures of psychological well-being, and tend to explain this phenomenon (often referred to as "the disability paradox")[4] with theories of "hedonic adaptation" (also known as "set-point theories"). Hedonic adaptation refers to the idea that individuals may experience temporary increases or decreases in well-being following a change in their life

[4] But cf. Koch (2000), who criticizes the notion of "disability paradox" (calling it "illusion of paradox") pointing out the circular thinking that underlies it.

circumstances, but they will reliably, and quickly, return to their baseline (or set-point) happiness levels (Brickman and Campbell, 1971).

The other position is represented by researchers who remain skeptical of such idea (e.g., Freedman, Stafford, Schwarz, Conrad, & Cornman, 2012; Infurna and Wiest, 2016; Lucas, 2007). These researchers argue that a close examination of the literature reveals no evidence that psychological adaptation to disability is ubiquitous or that its effects are as strong as they are claimed to be. For example, Diener, Suh, Lucas, and Smith (1999) pointed out that Mehnert, Krauss, Nadler, and Boyd's (1990) claim that "it is unwarranted to assume lower levels of life satisfaction, relative to the general population, for those with disabling conditions" is itself unwarranted. Although the study revealed that 68% of individuals with disabling conditions said they were somewhat or very satisfied with their lives, the percentage of individuals without disabling conditions who reported comparable levels of life satisfaction was much higher (90%). Furthermore, those with multiple disabling conditions were found to be less satisfied than those with a single condition. Similarly, Post and Van Leeuwen (2012), after reviewing the results of more than a dozen studies examining life satisfaction in samples of spinal-cord-injury (SCI) survivors, came to the following conclusion: "It thus appears that life satisfaction improves from an initial level early after SCI, but only to a level substantially below that of the general population" (p. 383).

It is worth noting that most of the research informing this debate does not allow the drawing of reliable conclusions regarding how disability might affect SWB (Anusic, Yap, & Lucas, 2014; Lucas, 2007). First, the majority of these studies are *cross-sectional* in design and limited to relatively *small* samples of individuals with *particular*

disabilities, such as spinal-cord-injury-related (Post & Van Leeuwen, 2012), amputation-related (Horgan & McLachlan, 2004), stroke-related (e.g., Clarke & Black, 2005), and intellectual (e.g., Emerson & Hatton, 2008) disabilities. Second, the fewer studies that are not cross-sectional tend to analyze longitudinal data that were collected *only after disability onset* (e.g., Hoffman, Bombardier, Graves, Kalpakjian, & Krause, 2011). Disability is not a completely exogenous event; thus, failure to measure pre-disability levels of SWB prevents scholars from ruling out the possibility that observed between- and within-person differences in SWB following disability onset are due to pre-existing differences in SWB. In other words, like cross-sectional studies, longitudinal studies that fail to measure pre-disability levels of SWB cannot provide convincing conclusions regarding disability effects on SWB, because they do not control for selection effects. Third, the even fewer studies that have analyzed longitudinal data collected both before and after disability onset have tended to rely on samples of individuals recruited *because* they were likely to acquire disability (e.g., Ormel, Rijsdijk, Sullivan, Van Sonderen, & Kempen, 2002). This recruitment strategy raises the concern that participants formed an interpretation of the study's purpose and adjusted their responses accordingly—i.e., under- or over-rated their levels of SWB to fit what they believed to be the study's purpose. Thus, studies that have employed such strategy do not allow for ruling out the possibility that demand characteristics might have affected the results.

To address these limitations, researchers have turned to large-scale, nationally representative, longitudinal panel datasets to examine the impact of disability on SWB. This type of study offers several advantages over the types described above. First, participants are drawn from samples of individuals who were recruited randomly to be

representative of a national population—rather than because they had or were likely to acquire disability—and are asked questions about a wide variety of topics. Thus, the possibility that demand characteristics might influence responses is minimized. Second, participants are followed prospectively for an indefinite period (usually until death or study drop-out). This allows for (a) controlling for selection effects, because pre-disability data are available and therefore post-disability SWB can be compared to pre-disability SWB, and (b) examining both short- and long-term effects of disability, because data are collected, usually annually, for many years. Lastly, samples are large and allow more confidence to be placed in conclusions regarding changes in SWB before and after disability.

The first researcher to take advantage of this type of dataset to examine the degree to which disability affects subjective well-being was Lucas (2007). Lucas (2007) conducted a two-study investigation using data drawn from the first 19 waves of the German Socioeconomic Panel (Study 1) and from the first 12 waves of the British Household Panel Survey (Study 2). Study 1 examined the short- and long-term effects of disability on life satisfaction. Study 2 replicated and extended Study 1 by examining disability-related changes in both life satisfaction and psychological distress (as measured with the General Health Questionnaire). In both studies, disability status was determined from a question asking participants if they were officially certified as being disabled.

Results of multilevel models showed that participants' life satisfaction decreased significantly following disability onset and never returned toward (let alone to) baseline. Conversely, participants' psychological distress increased significantly in the year immediately following disability onset, compared to the 2 years immediately before; in

the succeeding years, it did rebound, but never completely. In fact, even after 5 years, it was still 0.47 standard deviations above baseline. Because these results held after controlling for income and employment status, Lucas (2007) interpreted them as evidence that disability leads to significant declines in subjective well-being, and thus (a) hedonic adaptation to disability is far from inevitable, and (b) if such adaptation occurs, it is minimal.

Two subsequent studies supported this interpretation. Anusic et al. (2014) analyzed data drawn from 13 waves of the Swiss Household Panel (SHP) and found that the first year participants reported not being able to work due to disability, their life satisfaction dropped by 0.86 points (or 0.82 standard deviations), a statistically significant amount. By the fifth year following disability onset, life satisfaction levels had rebounded somewhat (by 0.48 points) but remained significantly lower than baseline levels (by 0.36 standard deviations). Similarly, Infurna and Wiest (2016), using data drawn from the first 28 waves of the German SOEP, found that participants' life satisfaction declined in the 2 years leading up to disability (*anticipation*), substantially dropped the first year participants reported being officially certified as having disability (*reaction*), and never returned to baseline (*adaptation*). In fact, 5 years after disability onset, life satisfaction was still significantly lower than it was the year immediately after onset.

Several other studies, however, did not replicate these findings. Oswald and Powdthavee (2008), in their two-study investigation using data from the British HPS and the German SOEP, found that life satisfaction fell abruptly the year of disability onset, but then evidenced a rapid return toward pre-disability levels. Within two years of reporting being disabled, individuals who indicated having severe disability (i.e., being

unable to perform at least one ADL) had already recovered more than 30% of their losses in life satisfaction, and those who indicated having moderate disability (or, being able to perform ADLs) were halfway to full recovery (50% up from the initial drop).

Powdthavee (2009), Pagán-Rodríguez (2010, 2012), and Braakmann (2014), using the same two datasets, found more or less similar results. Specifically, Powdthavee (2009), who analyzed data from 2,122 individuals drawn from nine waves of the BHPS, found that, after an initial significant decline coinciding with the year of disability onset, life satisfaction returned to baseline within 2 and 4 years for the moderately and the severely disabled individuals, respectively.

Pagán-Rodríguez (2010), using data from 479 adult males aged 21-58 from the GSOEP found that life satisfaction declined slightly in the two years before participants first reported a reduced capacity to work due to disability, dropped by a significant 1 point the year of disability onset, and then started to rise back up, reaching pre-disability levels 3 years later. In a subsequent study, Pagán-Rodríguez (2012) partially replicated these findings in a slightly larger sample again drawn from the GSOEP. Disability onset again was found to significantly reduce life satisfaction for adult males aged 21-58 (*reaction*). However, the results showed (a) strong anticipation effects, with participants' life satisfaction declining sharply starting 2 years before disability, and (b) full adaptation, but not before 4 years following disability onset. Lastly, Braakmann (2014), who also analyzed data from the GSOEP, found that disability had a significant negative impact on both men's and women's life satisfaction. He also found that, although neither men nor women adapted to the disability of their partner, they both partially adapted to

their own disability, in ways virtually identical to those reported by Oswald and Powdthavee (2008).

To summarize, all researchers examining disability-related changes in SWB with data drawn from large-scale, nationally representative, longitudinal datasets found evidence of a significant decline in SWB following the onset of disability. However, results differed widely regarding adaptation effects, with one set of studies finding little to no evidence of partial (let alone complete) adaptation (Anusic et al., 2014; Infurna & Wiest, 2016; Lucas, 2007), and another finding that SWB reliably, and quickly, returns toward (if not to) baseline after its initial decline. The reasons for such discrepancy in results are unclear, as are the reasons for why adaptation was found to be complete in some studies and only partial in others, or for why Pagán-Rodríguez (2012) found evidence of anticipation effects whereas Pagán-Rodríguez (2010) and Infurna and Wiest (2016) did not. However, as others have pointed out (Powdthavee, 2009; Yap et al., 2014), given that the majority of these studies utilize the same datasets, it is likely that discrepancies are, at least in part, the result of differences in methodology and analytical techniques.

For example, there are notable differences in the criteria researchers used to include or exclude participants in their analytical samples. Oswald & Powdthavee (2008), Powdthavee (2009), Pagán-Rodríguez (2010, 2012) and Braakmann (2014) included in their analyses all respondents who reported acquiring disability at some point during the course of the study, including those whose disability was permanent and those who eventually recovered. In contrast, Lucas (2007), Anusic et al. (2014), and Infurna and Wiest (2016) excluded from their final analytical samples those individuals who reverted

to a non-disability state during the course of the study. Similarly, Lucas (2007), Anusic et al., (2014), and Infurna and Wiest (2016) used multilevel modeling techniques to analyze their data, instead of fitting fixed-effect models, whose estimates are only generalizable to the sample (not to the population of interest), as all other studies did.

The Moderating Roles of Age at Disability Onset and Type of Disability

While part of the reason for discrepancies in empirical findings is likely to be methodological in nature, another important explanation may lie in the fact that different people might respond differently to their disability, depending on a variety of intra- and extra-individual factors.

This idea is implicitly articulated in the Disablement Process Model (DPM; Verbrugge & Jette, 1994). Indeed, the DPM does not assume that everyone diagnosed with a pathology (be it a disease, injury, or congenital/developmental condition) eventually becomes disabled, nor does it presuppose that all disabled individuals with the same underlying pathology arrive at disability in the same way. On the contrary, it recognizes individual differences both in patterns of progression from pathology to disability and in patterns of response to disability itself. In fact, one of the strengths of the model is its acknowledgement that the disablement process, and each of its stages, is preventable, modifiable, potentially reversible, and different across individuals.

The reason for the malleability and heterogeneity of the disablement process is attributed to its contextual embeddedness. In other words, the model recognizes that the disablement process does not occur in a bubble, with only biomedical factors operating. Instead, it is influenced by a complex interplay of idiosyncratic intra- and extra-individual variables, each of which plays a unique part in speeding up or slowing down

the progression from pathology to disability as well as in alleviating, maintaining, or aggravating disability itself. For example, if an individual with mild arthritis in the knees avoids walking for fear of falling (an intra-individual factor), he/she may become disabled sooner than an individual who does not have that fear. Similarly, an individual with severe arthritis in the knees who is disabled by his/her inability to climb the stairs leading to his/her second-floor apartment may revert to a non-disabled state if an elevator is built or if he/she moves to a house without stairs (an extra-individual factor) (Braungart Fauth, Zarit, Malmberg, & Johansson, 2007).

This idea is in line with, if not informed by, the lifespan developmental perspective. Designed to understand how individuals change over time, this perspective recognizes the inherent complexity of life events such as disability. Specifically, it recognizes that disability is a dynamic process embedded in historical, social, and personal contexts.

Contextual embeddedness implies that psychological adjustment to disability is contingent upon the specific circumstances under which disability occurs. These include specific characteristics of disability, such as its *timing* (measured by age at disability onset) and its *type* (determined by the functional impairment underlying it, such as physical, intellectual, psychological, etc…).

Age at disability onset. Theories of lifespan development have long recognized that disability may have an age-differential effect on subjective well-being. For example, according to the tri-factor model of development (Baltes et al., 1980), the dynamic and reciprocal relation between age-, history-, and non-normative-related influences differs during different stages of the life course. Specifically, the relative importance of age- and

history-related influences is speculated to follow a U-shaped curve bottoming out in early adulthood and an inverted U-shaped curve peaking in adolescence, respectively, whereas the relative importance of non-normative influences is theorized to increase as age increases (Baltes et al., 1980). This theory has led researchers to focus on non-normative events to understand development in late life, and, importantly, to expect disability to have a more substantial impact on SWB for older than for younger people.

Yet, disability may be less of a non-normative event in late life than it is in young adulthood and midlife. For example, physical health decrements that may lead to physical disability are normatively expected in late adulthood, whereas in young adulthood and midlife they are considered as "off-time" events (Wurm, Tomasik, & Tesch-Römer, 2008). Given the negative association postulated to exist between "off-time events" and subjective well-being (Hagestad & Neugarten, 1985), it is reasonable to expect that disability may have a worse impact on younger than on older adults.

Empirical research has yet to unravel this question. Only two of the aforementioned studies examining changes in SWB before and after disability onset investigated the extent to which timing of disability moderates the effect of disability on SWB, and they yielded dissimilar results. Lucas (2007) found that the older the participant at the time of disability onset, the more likely he/she was to report less steep declines in life satisfaction in the first year of disability (*reaction*). Infurna and Wiest (2016), on the other hand, found that old age had no protective effect against the short-term negative consequences of disability on LS. In fact, individuals who became disabled after the age of 85, not only showed the strongest (negative) reaction to disability onset, they also showed the least ability to bounce back in the years thereafter (*adaptation*).

Conversely, individuals who acquired disability in midlife (between the ages of 40 and 64) reported a significantly greater capacity to adapt than did individuals who became disabled either in late adulthood (> 65) or in young adulthood (< 39).

Given these conflicting results, it remains an open question whether and how age at disability onset plays a moderating role in the relation between disability and life satisfaction. A question also exists as to whether disability may have an age-differential effect on the affective component of SWB (positive affect and negative affect).

Type of disability. No existing study examining trajectories of subjective well-being before and after disability onset (e.g., Infurna & Wiest, 2016, reviewed above) probed the question of whether the impact of disability on SWB varies as a function of disability type. For a review of current knowledge on this topic, therefore, we must turn to the cross-sectional (and/or non-prospective) literature—i.e., to studies that, at best, followed participants over time only *after* disability onset. The first such study (Mehnert, Krauss, Nadler, & Boyd, 1990) examined data on life satisfaction collected as part of the 1986 ICD (International Center for the Disabled) Survey of Disabled Americans. The sample (N = 675 working-age individuals who identified themselves as being "disabled" or having one or more disabling conditions), was subdivided into four groups according to type of disability or disabling condition: (a) physical (45%), (b) sensory (13%), (c) mental (9%), and (d) other disabling conditions, such as heart disease, respiratory or pulmonary disease, and cancer (29%). The mental disability group included individuals with mental illness (psychological disability) as well as persons with developmental delay and mental retardation (intellectual disability).

Results of chi-square analyses revealed that the disability groups differed significantly in levels of life satisfaction. Specifically, the physical disability group, the group of individuals with other disabling conditions, and the mental disability group reported significantly lower LS levels than did the sensory disability group. Individuals with physical, mental, and other disabilities did not differ significantly in LS levels among each other, although, notably, the mental disability group reported meaningfully higher life satisfaction than the other two groups.

Subsequent studies only partially replicated these results. A case in point is Uppal (2006), who analyzed cross-sectional data from 24,036 Canadian citizens living with disability (aged 15 to 65+ years) to investigate factors affecting their SWB, including type of disability. Uppal (2006) split his sample into the following six subsamples according to disability type: mobility, agility, seeing, speaking, hearing, and mental. The mental disability group included individuals who were "limited [in their daily activities] because of a learning disability, a mental health condition, an intellectual impairment, or because of labeling by others." Subjective well-being, defined as happiness, was an ordered variable ranging from 1 to 3, where 1 = very happy, 2 = pretty happy, and 3 = not too happy. Results of ordered logit regression showed that individuals with mental disability were significantly more likely than any other disability group to report being "not too happy."

Thus, like Mehnert et al. (1990), Uppal (2006) found that the impact of disability on SBW varied as a function of disability type. However, his results diverged from those of Mehnert et al. (1990) in two important ways. First, they failed to show that individuals with sensory disability (the seeing, speaking, and hearing groups) reported significantly

higher levels of SWB than any other disability group. Indeed, individuals with physical disabilities (the mobility and agility groups) were found to be no less likely to report being happy (including "pretty happy" and "very happy") than the sensory disability groups. Second, contrary to Mehnert et al. (1990), who observed that individuals with mental disability reported meaningfully higher life satisfaction than those with physical (and other) disabilities, Uppal (2006) found that mental disability was associated with significantly *lower* SWB than physical disability.

Neither Uppal (2006) nor Mehnert et al. (1990) offered an interpretation of their results. However, both of their major findings—i.e., (a) that individuals with sensory disability reported significantly higher LS than any other disability group (Mehnert et al., 1990) and (b) that people with mental disability were more likely than any other disability group to report low levels of SWB (Uppal, 2006)—are consistent with results from other lines of research.

For example, a vast literature on the impact of stigma on people with disability has shown that the prejudicial and discriminatory attitudes of the general population toward people with disability (public stigma) vary by type of disability. Specifically, mental disability—and particularly psychological disability (PD)—is consistently found to elicit more stigmatizing responses than any other type of disability, whereas the opposite is true for sensory disability (e.g., Ditchman et al., 2013). People typically have the least understanding of psychological disability and tend to perceive persons with PD as unpredictable and dangerous, despite evidence to the contrary (e.g., Crisp, Gelder, Rix, Meltzer, & Rowlands, 2000), or as undeserving of help because they are seen as in control of their disabilities and responsible for causing them (Corrigan, Markowitz,

Watson, Rowan, & Kubiak, 2003). Given the strong association between stigmatizing attitudes and quality of life, either directly or via social isolation and economic disadvantage (e.g., Ditchman et al., 2013), these findings suggest that psychological disability may have more of a negative impact on subjective well-being than any other type of disability.

Similarly, a recent longitudinal study examining the extent to which type of disability differentially affects risk of mortality revealed that, although all types of disability are associated with an increased risk of all-cause mortality and natural death, not all are associated with an increased risk of suicide (Park, Oh, Roh, & Moon, 2017). Specifically, individuals with sensory (and especially visual) disability, unlike persons with physical, mental, and "other" disabilities appear *not* to be at increased risk of suicide compared to people without disability. Given the strong association between low life satisfaction and suicide (e.g., Koivumaa-Honkanen et al., 2001), this finding suggests that sensory disability may have less of a negative impact on life satisfaction than physical, mental, and other disabilities.

Importantly, in Park et al.'s (2017) study, the mental disability group only included individuals with mental illness (psychological disability). Persons with developmental delay and mental retardation (intellectual disability) were treated as a separate group, and results showed that the two groups differed remarkably in risk of suicide. While individuals with intellectual disability did not present a heightened risk of suicide, those with psychological disability (the mental disability group) were the highest risk group for suicide. This finding shows that individuals with intellectual disability and

those with psychological disability are not a homogenous group, thus suggesting the need to analyze their data separately rather than pooling them together.

Livneh, Lott, and Antonak (2004), who also investigated between-person differences in SWB by type of disability, did make such a distinction. These researchers examined patterns of psychological adaptation to chronic illness and disability (CID) by conducting a cluster analysis on data collected from 121 American students aged 18 to 60 (mean age: 32) who registered with their universities' offices of disability services. Indicators of psychological adaptation included, among others, life satisfaction, perceived quality of life, and emotional distress as measured by the Reactions to Impairment and Disability Inventory (RIDI; Livneh & Antonak, 1990). Self-reported disabilities were classified into three broad categories: (a) physical-sensory, (b) cognitive-learning, and (c) psychiatric-emotional. The cognitive-learning category included learning and attention deficit disorders (intellectual disability), whereas the psychiatric-emotional category included mental illnesses (psychological disability).

Results of the cluster analysis revealed three broad groups reflecting degree of overall psychological adaptation to CID: (a) a psychologically well-adjusted group (Adaptive), (b) a psychologically risky group (Nonadaptive), and (c) an in-between group (Intermediately Adaptive). Type of disability was found to be associated with cluster membership, such that individuals with physical-sensory disability and those with cognitive-learning disability were most frequently represented in the Adaptive cluster and least frequently in the Nonadaptive cluster, whereas the opposite was true for individuals with psychiatric-emotional disability. That is, the latter were most frequently included in the Nonadaptive cluster and least frequently in the Adaptive cluster. Thus, in line with

Park et al.'s (2017) finding that disabled individuals with mental (i.e., psychological) disability are the most at risk for suicide, Livneh et al. (2004) found that disabled persons with psychological (or, psychiatric-emotional) disability are the most likely to report the lowest levels of life satisfaction and quality of life and the highest levels of emotional distress.

The Present Study

Both theoretical (e.g., Verbrugge & Jette, 1994) and empirical (e.g., Infurna & Wiest, 2016; Lucas, 2007) research strongly suggest a negative relation between high subjective well-being and disability. However, as our review of the literature has demonstrated, more (longitudinal) evidence is needed to corroborate and extend this finding. Longitudinal studies, and particularly studies based on data collection commenced *prior to* disability onset (prospective), have been relatively scarce and have yielded mixed results regarding the long- versus the short-term effects of disability on SWB (as well as regarding anticipation effects), with some studies finding only short-term negative effects and others finding both short- and long-term negative consequences. Furthermore, longitudinal studies that have examined changes in SWB before and after disability onset have limited their investigations to one dimension of SWB and, in addition, have largely neglected to examine moderating effects on the relation between disability and SWB, beyond that of the degree of disability severity.

This study addressed these gaps using longitudinal prospective survey data from a representative sample of Australian individuals ranging in age from 16 to 99 years. Specifically, we aimed to answers the following three questions: (1) to what extent are different dimensions of SWB—i.e., life satisfaction, positive affect, and negative affect—

sensitive to the onset of disability? (2) To what degree does an individual's age at disability onset moderate (i.e., attenuate or augment) the effects of disability on life satisfaction, positive affect, and negative affect? (3) Do the effects of disability on life satisfaction, positive affect, and negative affect vary by type of disability?

Based on previous theoretical and empirical work, we expected sustained disability-related declines in life satisfaction and positive affect and increases in negative affect. We hypothesized these changes would be more substantial for life satisfaction than for positive affect and negative affect. Our main hypothesis was that any observed overall patterns of change would differ based on age at disability onset and type of disability. We expected we would replicate Infurna and Wiest's (2016) finding that becoming disabled in midlife (40-64 years) results in less substantial and sustained declines in life satisfaction than acquiring a disability in young adulthood (16-39 years) or late adulthood (>65 years). We also expected this finding to extend to positive affect and negative affect. Lastly, we hypothesized psychological disability to be associated with the most substantial and the most sustained declines in SWB, followed by physical disability and sensory disability.

Method

Participants

The data for this study were drawn from Waves 1-16 (covering the period 2001-2016) of the Household, Income and Labour Dynamics in Australia (HILDA) Survey, an ongoing large-scale longitudinal dataset of Australian households and their inhabitants.

Households were selected via a multi-stage area-based random sampling design, and all household members older than 15 years of age were asked to participate. Surveys

conducted yearly via paper-and-pencil self-completed questionnaires supplemented by brief face-to-face (or phone) interviews. The surveys collected information at the individual and household levels on a wide range of topics, including socio-demographics, health, family dynamics, and economic and subjective well-being (see Summerfield et al., 2017, for further information on the HILDA Survey's design, data collection process, and assessment variables).

At Wave 1, 7,682 households agreed to participate, generating a sample of 15,127 eligible respondents. In 2011, the number of eligible respondents (14,352) was increased by more than 29% (to 18,634) through the addition to the main household sample of 2,153 households (Summerfield et al., 2017), mainly as a way to address the under-representation of immigrants who had entered the country over the previous decade, whilst boosting the overall sample size (Watson, 2014). In 2016, the sample comprised 18,684 eligible respondents, 94.7% of whom returned the questionnaire, including 6,179 individuals who participated in all waves (Summerfield et al, 2017).

With initial response rates of 66% and 92% for households and individuals, respectively, and an average overall wave-on-wave individual attrition rate of about 5% (range: approximately 3-13%; see Summerfield et al., 2017, for details), the HILDA Survey compares favorably to other long-running panels, such as the German Socio-Economic Panel (SOEP) and the British Household Panel Survey (BHPS) (Watson, 2012). Moreover, although longitudinal attrition is not random (but, instead, related to a range of demographic characteristics, including age, marital status, state of residence, country of birth, and indigenous status), attrition-adjusted statistical weights provided

with the dataset enable subsamples to be representative of the Australian population aged 15 and over living in private dwellings.

For this study, we analyzed data from those participants who (a) were not disabled at study onset but became disabled at some point during the course of the study, (b) did not revert back to a non-disability state during the course of the study, and (c) provided data on the variables of interest. In total, 9,573 participants met our first two inclusion criteria. Of those, 1,272 were excluded from the analyses due to missing data on one or more variables of interests, resulting in a sample size of 8,301. This sample was further restricted to those participants (N = 3,795) who reported having a physical, sensory, or psychological disability only (see below for rationale and details).

On average, participants were in the study for 6.94 years before and 7.94 years after the onset of disability (range: 1-15 years before and 1-14 years after).[5] As shown in Table 1, they were, on average, 50.22 years of age at disability onset (SD = 17.40, range: 16-99), 51.45% were women, 68.24% were married, 56.58% had received a high school diploma, and they had an average annual household income of approximately 30,000 Australian dollars (M = 34,254; SD = 45,991).

Measures

Disability and disability onset. The presence of disability was determined from the following question, asked at each wave: "Do you have any long-term health condition, impairment or disability that restricts you in your everyday activities, and has

[5] This indicates that likelihood of participation in the study did not decrease following disability onset. For this reason, we deemed it unnecessary to compare the subsample of participants who left the study after disability onset with the parent sample (to determine whether they might differ significantly on the variables of interest).

lasted or is likely to last, for 6 months or more?" Respondents were presented with a prompt in the form of a showcard listing examples of health conditions, impairments, and disabilities. Responses were either *Yes* or *No*. Disability onset was operationalized as the first wave at which the participant reported having a disability. On average, participants were 50.22 years of age at disability onset (*SD* = 17.40; range: 16-99).

Type of disability. At every wave starting at Wave 3, participants who answered positively to the question above were then asked to select, from a list of 17 items, which disability(ies) affected them; they were instructed to select any item(s) that applied. For the purpose of this study, we classified the 17 disability types into the five categories recognized by the Australian Bureau of Statistics: physical, sensory, psychological, intellectual, and other/not specified disabilities. *Physical* disabilities included "chronic or recurring pain," "difficulty gripping things," "blackouts, fits, or loss of consciousness," "shortness of breath or difficulty breathing," "limited use of arms or fingers," "limited use of feet or legs," "any condition that restricts physical activity or physical work (e.g., back problems, migraines)," and "any disfigurement or deformity." *Sensory* disabilities were represented by sight, hearing, and speech problems that cannot be corrected. *Psychological* disabilities included "a nervous or emotional condition which requires treatment," "any mental illness which requires help or supervision," and "long term effects as a result of a head injury, stroke or other brain damage." *Intellectual* disabilities were learning difficulties. Disabilities classified as *other/not specified* included "a long-term condition or ailment which is still restrictive even though it is being treated" and "any other long-term condition such as arthritis, asthma, heart disease, Alzheimer's disease, dementia, etc…"

Of the 8,301 individuals in our sample who reported having a disability and provided data on our variables of interest, 2,242 failed to indicate what type of disability they had or reported having more than one type of limitation. We excluded them from our analytical sample. We further excluded (a) individuals with intellectual disabilities, because the sample (n = 53) was too small to allow for reliable conclusions to be drawn about this group, and (b) individuals with other/not specified disabilities (n = 2,211), due to theoretical considerations. We reasoned that this category included not disabilities per se but rather disabling conditions or pathologies, as defined by the Disablement Model, and therefore including it would not add meaningful information on how type of disability might moderate the relation between disability and SWB. Thus, our final analytic sample comprised 3,795 individuals. Of these, 2,369 (or 62.42%) reported having only a physical disability, 785 (or 20.69%) indicated having only a sensory disability, 641 (or 16.89%) reported having only a psychological disability.

Subjective well-being.

Life satisfaction. Life satisfaction (LS) was assessed at each wave with the question: "All things considered, how satisfied are you with your life?" Responses were recorded on an 11-point scale ranging from 0 (*totally unsatisfied*) to 10 (*totally satisfied*). On average, participants provided 13.72 LS observations (SD = 3.61; range: 2-16). Life satisfaction is considered a measure of cognitive-evaluative (as opposed to emotional) subjective well-being. Typically, it is assessed with the multiple-item Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), a psychometrically well-established instrument. The single-item scale used in the HILDA Survey has shown high

degree of criterion validity with the SWLS, zero-order $r = 0.62–0.64$, disattenuated $r = 0.78–0.80$ (Cheung and Lucas, 2014).

Positive affect. Positive affect (PA) was assessed at every wave by asking participants to rate on a scale from 1 (*all of the time*) to 6 (*none of the time*) "How much of the time during the past 4 weeks…" "Did you feel full of life?", "Have you felt calm and peaceful?", "Did you have a lot of energy?", and "Have you been a happy person?" The four items were reverse-coded—such that higher scores represented more frequent experience of positive affect—and aggregated into a single PA score. On average, participants provided 13.17 PA observations (*SD* = 3.78; range: 1-16). Cronbach's alphas ranged from .85 to .90 values from Wave 1 to Wave 16, indicating a high degree of internal consistency.

Negative affect. At each wave participants reported on their level of negative affect (NA) by answering five questions beginning with the stem "How much of the time during the past 4 weeks…" using a 1 (*all of the time*) to 6 (*none of the time*) scale. The specific questions were "Have you been a nervous person?", "Have you felt so down in the dumps nothing could cheer you up?", "Have you felt down?", "Did you feel worn out?", and "Did you feel tired?" A single NA score was calculated by aggregating these five items, after they had been reverse-coded such that higher scores reflected more frequent experience of negative affect. On average, participants provided 13.17 NA observations (*SD* = 3.77; range: 1-16). Cronbach's alphas ranged from .81 to .86 values from Wave 1 to Wave 16, indicating more than adequate internal consistency.

Covariates.

Gender. A categorical variable with two categories ("women" and "men") was created based on self-reported information. Women were slightly more represented than men (51.45% versus 48.55%).

Marital status. Marital status was determined from responses to a question asking participants to indicate whether they were legally married, in a de facto marriage, separated, divorced, widowed, or never married. A categorical variable with two categories was created: "married" (including legally married individuals and those who reported being in a de facto marital relationship) and "not married." Most respondents were married (68.24%).

Education level. A categorical education level variable was constructed based on a survey question asking respondents to report the highest level of education they attained. The categories were "at least high school education" and "no high school." Less than half of the respondents (43.42%) reported not having a high school diploma.

Income. Income was divided into three categories based on reported gross annual household income (in Australian dollars): 0 (AU$ 0), 1 (up to 29,999), and 2 (AU$ 30,000 or more). More than one third of the respondents (37.47%) reported having no income.

Reliable comfort. A reliable comfort variable was created using four items assessing, at every wave, the degree to which respondents felt supported when needed. The four items, evaluated on a scale from 0 (*strongly disagree*) to 6 (*strongly agree*), were "People don't come to visit me as often as I'd like," "I often need help from other people but can't get it," "I don't have anyone I can confide in," and "I have no one to lean on in times of trouble." The items were reverse-coded—such that lower scores were

indicative of lower perceived sense of social support in times of need—and averaged to form a single index of reliable comfort. Cronbach's alphas ranged from .71 to .78 values from Wave 1 to Wave 16, indicating adequate internal consistency for between-person comparisons. Overall, participants reported a high level of reliable comfort (M = 4.27, SD = 1.29, range: 0-6).

Statistical Analyses/Analytical Strategy

We used multi-phase growth curve modeling (Cudeck & Klebe, 2002; Fauth et al., 2014; Grimm, Ram, & Estabrook, 2016; Ram & Grimm, 2007) to examine our research questions. Specifically, *two*-phase growth curve models were fit to the data to (a) establish the extent to which different facets of subjective well-being (i.e., life satisfaction, positive affect, and negative affect) changed along a time-to/from-disability onset axis, and (b) examine the extent to which age at disability onset and type of disability moderated such changes. The two phases corresponded to all the years leading up to disability onset and all the years following disability onset.

At Level 1, capturing within-person change in subjective well-being over the time-to/from-disability onset axis, the models were specified with the following equation (Equation 1):

$$Y_{ti} = \beta_{0i} + \beta_{1i} \min(0, t_i) + \beta_{2i} X_1 + \beta_{3i} \max(t_i - 2, -2) + \varepsilon_{ti}$$

In the equation, Y_{ti} represents individual i's level of life satisfaction, positive affect, or negative affect at time t. β_{0i} is an intercept parameter that represents individual i's level of LS, PA, or NA two years after the onset of disability. β_{1i} is a slope parameter capturing direction and rate of linear change in LS, PA, or NA for individual i in the

period preceding disability onset. We referred to this parameter as "*Pre*" in our tables. β_{2i} is an individual-specific parameter detecting level change in LS, PA, or NA the year surrounding disability onset (*Reaction*). β_{3i} is a slope parameter characterizing direction and rate of linear change in LS, PA, or NA in the period following disability onset, which we named "*Post*" in our tables, and ε_{ti} is the residual error for individual *i* at time *t* . *t* refers to the number of years to-/from-disability onset; it was obtained by realigning each individual's time series along the common event of disability onset. The minimum function min(0,t_i) represents the period preceding the year of disability onset (Year 0). X_1 is a time-varying dummy-coded variable that was created to isolate the transition into disability (i.e., Year 0). Accordingly, it was coded as 0 for all the years prior to disability, as 1 for the observation of the reported disability (Year 0), and as 0 for all time-points following disability onset. The maximum function max($t_i - 2,-2$) refers to the number of years separating individual *i*'s time *t* (in years) *from* the year of disability onset. The function uses " -2 " instead of "0" to allow for the intercept to be set at two years after disability onset, Year +2.

At Level 2, capturing between-person variation, the models were specified by the following equations (Equations 2, 3, 4, and 5):

$$\beta_{0i} = \gamma_{00} + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + u_{1i}$$

$$\beta_{2i} = \gamma_{20} + u_{2i}$$

$$\beta_{3i} = \gamma_{30} + u_{3i}$$

In the equations, β_{0i}, β_{1i}, β_{2i}, and β_{3i} (the individual-specific intercept and slope parameters from the Level-1 models given in Equation 1) are a function of two types of factors: (a) *fixed effects* (the model coefficients), which represent between-person mean level and rates of change (γ_{00}, γ_{10}, γ_{20}, γ_{30}) and (b) individual-specific *random effects* (i.e., u_{0i}, u_{1i}, u_{2i}, and u_{3i}), also known as Level-2 residuals. These latter capture inter-individuals differences in level and rate of change and were assumed to be normally distributed, correlated with each other, and uncorrelated with the residual errors, ε_{ti}.

Linear and quadratic terms for participants' age at disability onset, and linear terms for the three types of disability, and for participants' gender, marital status, education level, income, and mean levels of reliable comfort were added to the models as Level-2 (between-person) moderators of Level-1 models' parameters β_{0i}, β_{1i}, β_{2i}, and β_{3i}. For example, to examine moderation by age-at-disability-onset, without adjusting for any other variables, our models (Models 2) were specified by the following Level-2 equations:

$$\beta_{0i} = \gamma_{00} + \gamma_{01} Age_i + \gamma_{02} Age_i^2 + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11} Age_i + \gamma_{12} Age_i^2 + u_{1i}$$

$$\beta_{2i} = \gamma_{20} + \gamma_{21} Age_i + \gamma_{22} Age_i^2 + u_{2i}$$

$$\beta_{3i} = \gamma_{30} + \gamma_{31} Age_i + \gamma_{32} Age_i^2 + u_{3i}$$

Of particular interest was whether these variables were related to individuals' pre-disability-onset slopes (β_{1i}) and reaction to (β_{2i}) and adaptation to disability onset (

β_{3i}). All continuous moderator variables (i.e., age at disability and reliable comfort) were grand-mean centered.

Analyses were performed using SAS PROC MIXED (SAS Version 9.4). Maximum likelihood estimation was used to estimate the parameters, and the goodness of fit of the models was evaluated through the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Missing data were assumed to be missing at random (MAR) at the within-person level and, to retain longitudinal data, missing completely at random (MCAR) at the between-person level (Little & Rubin, 2014). We checked for patterns of missing data in LS, PA, and NA that could be attributed to between-person differences in key variables of interests. Specifically, we conducted regression analyses regressing number of observations provided before and after disability onset for LS, PA, and NA on age-at-disability-onset, type of disability, gender, marital status, education level, income, and reliable comfort. We then compared standardized regression coefficients using the formula $Z = \frac{b_1 - b_2}{\sqrt{SE_{b1}^2 + SE_{b2}^2}}$. The results showed that number of observations provided before and after disability onset for LS, PA, and NA differed based on age-at-disability-onset ($Z > 1.645$) but did not differ based on gender, type of disability, marital status, education level, income, and reliable comfort (Zs = -.19 to .83). Analyses are available upon request.

Results

The Effect of Disability on Life Satisfaction, Positive Affect, and Negative Affect

To address our first research question, we estimated three "unconditional" (i.e., with no other predictors than the time variables) multiphase growth curve models, one

each of our outcomes: life satisfaction, positive affect, and negative affect. The results are given in Table 5 and Figures 1a, 1b, and 1c. The fixed effect estimates displayed in the first column of Table 5 indicate that, on average, LS declined in the period leading up to disability onset (*pre*: γ_{10} = -0.01, $p < .01$), dropped substantially the year of onset (*reaction*: γ_{20} = -0.15, $p < .01$), and then stopped declining and, in fact, showed a tendency to rebound in the years thereafter (*post*: γ_{30} = 0.01, $p < .01$). However, importantly, it never returned to pre-disability-onset levels, as graphically illustrated by the red line in Figure 1a.

Similarly, as indicated by the fixed effect estimates displayed in the second column of Table 5, average levels of positive affect decreased in the period preceding disability onset (*pre*: γ_{10} = -0.01, $p < .01$), dropped significantly the year surrounding disability onset (*reaction*: γ_{20} = -0.13, $p < .01$), and then stopped declining but did not rebound in the years thereafter (*post*: γ_{30} = 0.002, $p > .05$). The red line in Figure 1b graphically illustrates this course of change. Conversely, as indicated by the fixed effect estimates displayed in the third column of Table 5, levels of negative affect, on average, remained stable in the period leading up to disability onset (*pre*: γ_{10} = -0.003, $p > .01$), increased significantly the year surrounding disability onset *(reaction*: γ_{20} = 0.10, $p < .01$), and then showed a tendency to return toward baseline (*post*: γ_{30} = -0.01, $p < .01$). However, as illustrated by the red line in Figure 1c, the return (decrease) in the years following disability onset never brought levels of NA back to their pre-disability-onset values.

Taken together, these results suggest that (a) the average courses of change in LS, PA, and NA before and after disability onset are comparable, (b) on average, individuals experience substantial declines in SWB as a function of the disablement process, and (c) these declines are not sustained over time but levels of SWB never fully return to pre-disability-onset values.

The random effect estimates displayed at the bottom of Table 5 indicate substantial between-person differences in the extent to which LS, PA, and NA changed before and after disability onset. This is also evident from the grey lines in Figures 1a, 1b, and 1c, which represent a "spaghetti plot" of data obtained from a subset of 200 participants. No two grey lines trace the same trajectory of LS, PA, or NA along the time-to-/from-disability onset axis. This observation begs the question of what factors might contribute to such between-person variation. We addressed this question in the second part of this study, beginning with a set of analyses designed to examine whether and to what extent *age at disability onset* might moderate disability-related changes in LS, PA, and NA.

The Moderating Role of Age at Disability Onset

To address our second research question, we estimated a set of three multiphase growth curve models that included linear and quadratic terms for age at disability onset (*Age* and Age^2) as predictors/moderators. The results are given in Table 6 and Figures 2a, 2b, and 2c. The fixed effect estimates displayed in the first column of Table 6 indicate that age at disability onset significantly moderated average changes in life satisfaction in the period leading up to disability onset (*pre* × *age*: $\gamma_{11} = 0.01$, $p < .01$; *pre* × age^2: $\gamma_{12} = -0.004$, $p < .01$) and in the years thereafter (*post* × age^2: $\gamma_{32} = -0.01$, $p < .01$). No

moderation effect of age at disability onset was found on the relation between reaction and life satisfaction (*reaction* × *age*: $\gamma_{21} = 0.01$, $p > .05$; *reaction* × age^2: $\gamma_{22} = -0.01$, $p > .05$), indicating no differences in the way LS levels changed the year surrounding disability onset based on individuals' age at disability onset.

Figure 2a provides a graphic representation of these results. In the figure, the three colored lines, derived from the model's fixed effect estimates, represent average trajectories of LS along the time-to/from-disability onset axis for individuals in young adulthood (30 years old), midlife (50 years old), and old age (70 years old). They show that the three age groups did not differ in their initial response to disability onset; they all experienced an equally significant drop in levels of life satisfaction the year they first reported having disability. However, in the years thereafter, individuals in midlife showed a tendency to return to baseline, individuals in young adulthood only showed a tendency to return toward (but not to) baseline, and individuals in old age showed no such tendency and instead reported sustained lower levels of, and even a slight decline in, life satisfaction. This slight decline is all the more meaningful because it cannot be attributed to a general tendency for older adults' LS to decline over time. Indeed, contrary to individuals in young adulthood, whose average levels of life satisfaction declined in the period preceding disability onset, individuals in old age, on average, reported increases in LS prior to disability onset.

The second column of Table 6 shows similar results for positive affect. Specifically, the fixed effect estimates indicate a significant age-differential effect on average rates of change in PA in the period prior to disability onset (*pre* × *age*: $\gamma_{11} = 0.01$,

$p < .01$; *pre* × *age*^{2}:$\gamma_{12} = -0.002$, $p < .01$) and in the years thereafter (*post* × *age*: $\gamma_{31} = -0.01$, $p < .01$; *post* × *age*^{2}:$\gamma_{32} = -0.003$, $p < .01$) but not on average *level* changes the year surrounding disability onset. The interaction parameters involving reaction did not reach statistical significance (*reaction* × *age*: $\gamma_{21} = -0.004$, $p > .05$; *reaction* × *age*^{2}: $\gamma_{22} = -0.001$, $p > .05$). As illustrated in Figure 2b, these results suggest that age at disability onset had no moderating effect on individuals' initial response to disability onset; all age groups reported equally significant drops in PA the year of disability onset. However, whereas individuals in midlife and those in young adulthood showed a tendency to rebound following the initial drop, individuals in old age, on average, showed no such tendency; in fact, their levels of PA further declined after the initial drop. As in the case with LS, this decline in PA in the years following disability onset is meaningful because it cannot be attributed to a general tendency for older adults' PA to decrease over time. Indeed, unlike young adults' PA, older adults' PA showed no average (linear) decline in the years preceding disability onset.

The third column of Table 6 shows comparable results for negative affect. The fixed effect estimates at the top of the column indicate that age at disability onset had no moderating effect on changes (increases) in NA levels the year when disability was first reported (*reaction* × *age*: $\gamma_{21} = -0.02$, $p > .05$; *reaction* × *age*^{2}: $\gamma_{22} = 0.003$, $p > .05$) but did have a moderating effect on both pre-and post-disability-onset slopes. Indeed, the two sets of interaction parameters representing the influence of age at disability onset on rates of change in NA before disability onset (*pre* × *age*: $\gamma_{11} = -0.003$, $p < .01$; *pre* × *age*^{2}:$\gamma_{12} = 0.002$, $p < .01$) and those representing age moderation of changes in NA following

disability onset (*post* × *age*: $\gamma_{31} = 0.01$, $p < .01$; *post* × age^2: $\gamma_{32} = 0.002$, $p < .01$) were both statistically significant. Figure 2c provides a graphic illustration of these results. The three colored lines—representing average trajectories of NA for individuals in young adulthood, midlife, and old age—show that the three age groups did not differ in their initial reaction to disability onset; they all experienced an equally significant increase in NA the year of disability onset. However, whereas individuals in midlife and, to a lesser extent, those in young adulthood showed a tendency to return to baseline following disability onset, individuals in old age showed no such tendency and, in fact, reported sustained increases in NA in the years thereafter. This increase is all the more meaningful in light of the fact that it did not constitute the continuation of a pre-existing trend; instead, it only began the year of, and is thus attributable to, disability onset.

Taken together, these findings suggest that (a) age at disability onset does have moderating effects on disability-related changes in LS, PA, and NA, (b) these moderating effects are comparable across the three dimensions of SWB, and (c) SWB is most likely to show only short-term declines when disability onset occurs in midlife. Conversely, when disability onset occurs in old age, SWB is most likely to show both short- and long-term declines.

The Moderating Role of Type of Disability

In a subsequent set of three multiphase growth curve models, we included type of disability as a predictor/moderator to examine whether the effect of disability on life satisfaction, positive affect, and negative affect varied by disability type (physical, sensory, psychological). The results are given in Table 7 and Figures 3a, 3b, and 3c. The fixed effect estimates displayed in the first column of Table 7 indicate significant

differences among the three disability groups in level and rates of change in life satisfaction before and after disability onset. The physical disability group, on average, did not report significant declines in LS in the period preceding disability onset (*pre* × *physical*: γ_{13} = -0.01, $p > .05$) but showed both a significant reaction to disability onset (*reaction* × *physical*: γ_{23} = -0.14 + 0 = -0.14, $p < .01$) and no significant signs of adaptation in the years thereafter (*post* × *physical*: γ_{33} = 0.002 + 0 = 0.002, $p > .05$). The black line in Figure 3a graphically illustrates this course of change. The sensory disability group, on the other hand, as illustrated by the blue line in Figure 3a, reported no significant changes in LS at any time point (*pre* × *sensory*: γ_{11} = -0.01 + 0.002 = -0.008, $p > .05$; *reaction* × *sensory*: γ_{21} = -0.14 + 0.11 = -0.03, $p > .05$; *post* × *sensory*: γ_{31} = 0.002 + -0.01 = -0.008, $p > .05$). Yet different was the pattern of changes in average levels of LS for the psychological disability group. As illustrated by the magenta-colored line in Figure 3a, average levels of LS for this group decreased in the period preceding disability onset (*pre* × *psychological*: γ_{12} = -0.01 + -0.02 = -0.03, $p < .01$). They further decreased (and more substantially so than did those of the physical disability group) the year disability was first reported (*reaction* × *psychological*: γ_{22} = -0.14 + -0.16 = -0.30, $p < .01$), but then bounced back (*post* × *psychological*: γ_{32} = 0.002 + 0.08 = 0.082, $p < .01$), returning to baseline within 5 years after disability onset.

The second column of Table 7 shows somewhat similar results for positive affect. The fixed effect estimates at the top of the column indicate that the effect of disability on PA varied greatly by type of disability. Physical disability was associated with a substantial drop in levels of PA the year when disability was first reported (*reaction* ×

physical: γ_{23} = -0.14 + 0 = -0.14, $p < .01$) and no significant propensity for PA to rebound in the years thereafter (*post* × *physical*: γ_{33} = 0.002 + 0 = 0.002, $p > .05$), as graphically illustrated by the black line in Figure 3b. Sensory disability was not associated with a significant drop in levels of PA the year when disability was first reported (*reaction* × *sensory*: γ_{21} = -0.14 + 0.11 = 0.03, $p > .05$) but rather with a steady, linear decline in PA following disability onset (*post* × *sensory*: γ_{31} = 0.002 + -0.03 = -0.028, $p < .01$), as graphically illustrated by the blue line in Figure 3b. Psychological disability was associated with the most substantial drop in levels of PA the year when disability was first reported (*reaction* × *psychological*: γ_{22} = -0.14 + -0.08 = -.0.22, $p < .01$) but also with a significant propensity for PA to return to pre-disability-onset levels in the years thereafter (*post* × *psychological*: γ_{32} = 0.002 + 0.04 = 0.042, $p < .01$). The magenta-colored line in Figure 3b graphically illustrates this course of change.

The third column of Table 7 shows somewhat comparable results for negative affect. The fixed effect estimates displayed at the top of the column indicate that the three disability groups differed significantly from one another in the way they responded emotionally to disability, in terms of NA. The physical disability group, on average, showed a strong reaction to the onset of disability (as evidenced by the significant increase in mean levels of NA at Year 0; *reaction* × *physical*: γ_{23} = 0.10 + 0 = 0.10, $p <$ .01) followed by significant signs of adaptation in the years thereafter (*post* × *physical*: γ_{33} = -0.01 + 0 = -0.01, $p < .01$). The black line in Figure 3c illustrates this course of change. The sensory disability group, on the other hand, reported no significant increases in average levels of NA following disability onset (*reaction* × *sensory*: γ_{21} = -0.10 + -

= 0.03, $p > .05$; *post* × *sensory*: γ_{31} = -0.01 + 0.02 = 0.02, $p > .05$), as illustrated by the blue line in Figure 3c. The psychological disability group showed the strongest reaction to disability onset (as evidenced by the significantly greater increase in NA at Year 0, compared to that of the physical disability group; *reaction* × *psychological*: γ_{22} = 0.10 + 0.13 = -.0.22, $p < .01$) but also the strongest signs of adaptation (γ_{32} = -0.01 + -0.04 = -0.05, $p < .01$). In fact, as illustrated by the magenta-colored line in Figure 3c, for this group adaptation was complete within 5 years post-disability-onset.

Taken together, these results suggest that (a) type of disability has significant moderating effects on disability-related changes in SWB, (b) these changes are comparable across different dimensions of SWB (life satisfaction, positive affect, and negative affect), and (c) individuals with sensory disability are the least affected by disability. Conversely, individuals with physical disability are the most likely to report both short- and long-term declines in SWB as a result of acquiring disability.

Final models

In a final step, we estimated a set of three multiphase growth curve models that combined age at disability onset, type of disability, gender, education, income, marital status, and reliable comfort as predictors. The results are given in Table 8. The fixed effect estimates displayed in the first column of the table indicate that gender, education, income, marital status, and reliable comfort were all significant predictors of changes in life satisfaction before, at, and/or after disability onset. For example, gender significantly moderated the reaction parameter (*reaction* × *gender*: γ_{26} = -0.04 + -0.08 = -0.12, $p <$ .01) such that male participants were more likely than their female counterparts to show

substantial declines in LS the year when disability was first reported. At the same time, the results also showed that the moderating effects of age at disability onset and of type of disability on changes in life satisfaction before and after disability onset held after including all these variables. Specifically, age at disability onset moderated linear changes in LS both before and after disability onset (*pre* × *age*: $\gamma_{11} = 0.01$, $p < .01$; *pre* × *age*^{2}: $\gamma_{12} = -0.004$, $p < .01$; *post* × *age*^{2}: $\gamma_{32} = -0.01$, $p < .01$) such that individuals in young adulthood and those in old age were significantly more likely than individuals in midlife to experience declines in LS following disability onset. Type of disability moderated changes in LS such that psychologically-disabled individuals were significantly more likely than their physically-disabled and sensory-disabled counterparts to report declines in LS during the period leading up to disability onset (*pre* × *psychological*: $\gamma_{14} = 0.003 + -0.02 = -0.017$, $p < .01$) as well as the year when disability was first reported (*reaction* × *psychological*: $\gamma_{24} = -0.04 + -0.14 = -0.18$, $p < .01$). However, these individuals were also likely, unlike physically-disabled and sensory-disabled participants, to significantly rebound in the years thereafter (*post* × *psychological*: $\gamma_{34} = 0.002 + 0.08 = 0.082$, $p < .01$).

Similarly, the fixed effect estimates displayed in the second column of Table 8 indicate that gender, income, marital status, and reliable comfort (but not education) were all significant predictors of disability-related changes in *positive affect*. For example, marital status moderated linear changes in PA following disability onset (*post* × *married*: $\gamma_{26} = 0.01 + 0.01 = 0.02$, $p < .01$) such that not being married was significantly more likely than being married to predict a return toward baseline levels of PA after the

of disability. At the same time, as in the case with LS, the inclusion of these variables/covariates did not render the effects of age at disability onset and of type of disability insignificant. On the contrary, age at disability onset was still found to play a significant moderating role on changes in PA before (*pre* × *age*: $\gamma_{11} = 0.004$, $p < .01$; *pre* × age^2: $\gamma_{12} = -0.003$, $p < .01$) and after disability onset (*post* × *age*: $\gamma_{31} = -0.005$, $p < .01$; *post* × age^2: $\gamma_{32} = -0.003$, $p < .01$). These estimate indicate that people in old age were significantly more likely than their younger counterparts to report declines in PA following disability onset. Type of disability was found to significantly moderate disability-related changes in PA, such that people with physical disability and those with sensory disability were significantly more likely than their psychologically-disabled counterparts to experience long-lasting (as opposed to short-lived) drops in PA after the onset of disability.

The third column of Table 8 shows results for negative affect. The fixed effect estimates displayed at the top of the column indicate that gender, marital status, and reliable comfort (but not education and income) were all significant predictors of changes in NA across the disability transition. For example, reliable comfort significantly and positively interacted with the post-disability-onset slope parameter (*post* × *reliable comfort*: $\gamma_{315} = 0.01$, $p < .01$), indicating that disabled individuals who reported higher

levels of reliable comfort were significantly less likely than those who reported lower levels of reliable comfort to return to baseline levels of NA in the period following disability onset. In addition, as in the case with LS and PA, the effects of age at disability onset and of type of disability remained significant. Age at disability onset moderated

disability-related changes in NA such that the older the individual, the less likely his or her levels of NA were to bounce back after the initial significant drop (*post* × *age*: γ_{31} = 0.01, $p < .01$; *post* × age^2: $\gamma_{32} = 0.002$, $p < .01$). Type of disability moderated changes in NA throughout the disability transition (e.g., *reaction*: $\gamma_{20} = 0.07$, $p < .01$; *reaction* × *psychological*: $\gamma_{24} = 0.10 = p < .01$). These estimates indicate that disabled individuals' reaction and adaptation to disability varied greatly by type of disability, with psychologically-disabled people reporting, on average, the steepest increases in NA the year surrounding disability but also the highest capacity to rebound in the years thereafter.

Discussion

The present study applied multiphase growth-curve models to prospective longitudinal survey data collected from a large representative sample of Australians, aged 16 to 99 years, to estimate within-person changes in subjective well-being before and after disability onset. The goal of the study was threefold: (a) examine and compare changes across disability onset for three different facets of subjective well-being (life satisfaction, positive affect, and negative affect), (b) determine whether and how such changes differed by age at disability onset, and (c) determine whether and how they differed by type of disability.

Based on previous theoretical and empirical work, we expected sustained disability-related declines in life satisfaction and positive affect and increases in negative affect. We hypothesized these changes would be more substantial for life satisfaction than for positive affect and negative affect. Our main hypothesis was that any observed

overall patterns of change would differ based on age at disability onset and type of disability. We expected we would replicate Infurna and Wiest's (2016) finding that becoming disabled in midlife (40-64 years) results in less substantial and sustained declines in life satisfaction than acquiring a disability in young adulthood (16-39 years) or late adulthood (>65 years). We also expected this finding to extend to positive affect and negative affect. Lastly, we hypothesized psychological disability to be associated with the most substantial and the most sustained declines in SWB, followed by physical disability and sensory disability.

The Effect of Disability on Life Satisfaction, Positive Affect, and Negative Affect

Our first hypothesis was partially supported. We found that positive affect, on average, dropped to a statistically-significant degree the year when disability was first reported and then stopped declining but showed no signs of rebounding in the years thereafter. Conversely, average levels of negative affect increased to a statistically-significant degree the year when disability was first reported and then, despite rebounding somewhat, never fully returned to pre-onset levels.

We found a conceptually comparable pattern of change for life satisfaction, but only on a trend level. Our initial model (with no predictors but the time variables) revealed a statistically-significant decline in LS the year of disability onset followed by (only) partial adaptation in the years thereafter (see Figure 1a). However, this finding did not hold in our last model (controlling for age-at-disability-onset, type of disability, gender, educational level, income, marital status, and reliable comfort; see Table 8). Instead, our last model confirmed the direction, but not the strength, of post-disability-

onset changes, indicating that life satisfaction remained rather stable across the disability transition.

This latter result was surprising in light of previous theoretical (e.g., Verbrugge & Jette, 1984) and empirical (e.g., Infurna & Wiest, 2016) work suggesting a strong negative association between disability onset and life satisfaction. Indeed, even though not all previous studies found evidence of *long-lasting* disability effects, they all reported *a substantial drop* in life satisfaction immediately following onset.

One explanation for the diverging results may lie in the presence of cross-country differences. The present study used data from a sample representative of the Australian population; most other studies analyzed data from Germany (GSOEP), the U.K. (BHPS), or Switzerland (SHP). It may be that, compared to the citizens of Germany, Switzerland, and the U.K., Australians have access to more resources, personal or otherwise, that play a role in alleviating the negative impact of disability onset on SWB. For example, a recent study using representative samples of 142 countries around the world found Australians to be more optimistic than most other nations, including Switzerland, Germany, and the U.K. (Gallagher, Lopez, & Pressman, 2013). Optimism, defined as a person's positive expectations for the future, has been found to play an important role in shaping how people respond to the onset of chronic illness (e.g., multiple sclerosis, rheumatoid arthritis). Low optimism exposes people diagnosed with chronic illness to higher risk for reduced well-being (e.g., Dunn et al., 2013; Ferreira & Sherman, 2007; Martz & Livneh, 2016). It is possible that low optimism plays a similar role following the onset of a disability, thus explaining the steeper post-disability-onset declines in LS in Germans, Britons, and Swiss, compared to Australians.

It may also be that Australia offers better *material* and *social* resources to its disabled population, compared to Germany, Switzerland, and the U.K. According to a recent report by the OECD (2019), the Australian government's total spending on "incapacity due to disability, sickness, or occupational injury" has traditionally been much higher than that of the U.K. and Germany and, in recent years, even higher than that of Switzerland. For example, between 2000 and 2015, the last year for which data were available, Australia's total spending on incapacity—including cash benefits and benefits in kind (e.g., rehabilitation services, home-help services)—hovered around 2.4% of its GDP, almost half a point higher than the 2.0% of Germany and the U.K.

A second explanation for the observed discrepancy between our and previous studies' findings may lie in the presence of cohort-differences. Our data were collected between the mid-2000s and the mid-2010s and, as such, may reflect social progress in the treatment of and accommodations for persons with disability, across countries. Specifically, it may be that new anti-discrimination laws and civil-right protections for the disabled (Degener, 2016), coupled with the advent of ever-improving technologies to assist them in their everyday life, are facilitating greater psychological adaptation to disability onset, compared to previous decades. This would be consistent with several theories, including conceptual accounts of disability such as the Disablement Process Model (Verbrugge & Jette, 1994), suggesting that disability is a dynamic process shaped by a complex interplay of both biomedical and non-biomedical (including personal and environmental) factors embedded in *historical context*.

Although our hypothesis was only partially supported, our results cannot be interpreted as indicating a general process of hedonic adaptation following disability

onset. Such a characterization implies that individuals who acquire a disability, on average, either maintain or return to pre-disability-onset values of SWB. However, our results suggest that, although people' cognitive evaluations of their life (life satisfaction) remain rather stable across the disability transition, their *emotional* evaluations of their life (affective well-being) experience long-lasting negative changes, on average. Our results provide further evidence *against* the set-point theory of hedonic adaptation (Brickman and Campbell, 1971) and for a more moderate viewpoint that allows for processes of adaptation to differ based on the type of stressor (Diener, Lucas, & Scollon, 2009).

Differences among Life Satisfaction, Positive Affect, and Negative Affect

Our second hypothesis was not supported and, in fact, our analyses yielded two unexpected findings. First, cognitive well-being is *less*, not more, strongly affected by disability onset than is affective well-being. Second, there is a difference in the extent to which the two facets of affective well-being respond to the onset of disability; negative affect, on average, rebounds somewhat after an initial decline whereas positive affect, on average, shows no sign of rebounding whatsoever.

Plausible explanations for why cognitive well-being and affective well-being were found to be differentially sensitive to disability onset may be related to structural differences between the measures we used to assess them and the diverse time frames of these measures (i.e., global for life satisfaction versus "past 4 weeks" for positive and negative affects). A recent study suggests, however, that time frames typically do not moderate associations between cognitive and affective indicators of SWB and important correlates (e.g., life events) (Luhmann, Hawkley, Eid, & Cacioppo, 2012). Rather,

differences across indicators like the ones used in this study seem to reflect the use of different sources of information when making well-being judgments. Specifically, when making cognitive well-being judgements, people tend to evaluate global life circumstances, such as income and marital status, whereas, when they make affective well-being judgments, they tend to focus on recent events and specific activities, regardless of the particular time frame (Luhmann et al., 2012a). This is in line with the observation that life satisfaction results from cognitive evaluations that include the present situation as well as former phases of life (e.g., Smith et al., 1999). Life satisfaction may, therefore, be less suited to capture the daily strains that people likely experience when they transition into and learn to live with disability, compared to positive affect and negative affect. Alternatively, emotion-based well-being could be more responsive to disability onset purely because it involves less cognitive processing. Either way, this finding highlights the importance of including measures of affective well-being when assessing the effects of disability onset on SWB.

Following this line of reasoning, the differential sensitivity to disability onset of positive affect and negative affect may reflect the particular nature of the daily strains that accompany disability onset. Specifically, our results suggest that it is the absence of experiences that elicit positive affect, rather than the presence of experiences that elicit negative affect that burdens newly-disabled people the most, in the long-run. Experiences that elicit negative affect (e.g., relocating to a new, unfamiliar accommodation) may diminish over time, albeit slowly, but experiences that elicit positive affect (e.g., participating in a hobby, having joyful encounters with others) do not seem to increase over time. This has implications for public policy concerned with improving the life of

people with disability—and societal well-being in general. If, broadly speaking, people who acquire a disability may appraise their life as positively (or almost as positively) as they did before disability onset but still feel worse in emotional terms, and more so in terms of positive affect than in terms of negative affect, then different interventions may be needed to influence the different components of SWB.

Between-Person Differences

Our main research question was whether any observed overall patterns of disability-related change in SWB differ based on age at disability onset and type of disability. The results (discussed in the following sections) provided further clarity to the mixed findings of previous work, by confirming that it may be *when disability is acquired*, not *acquiring a disability* that results in long-term negative consequences for SWB (Lucas, 2007, Study 1; Infurna & Wiest, 2016). The results also suggested that type of disability is another important moderator of the relation between disability onset and SWB.

Before discussing these results, however, we note another important finding. Our analyses showed, consistent with Lucas (2007), Anusic et al. (2014), and Infurna and Wiest (2016), that there are substantial between-person differences in hedonic responses to disability onset—whether based on age at disability onset (timing of disability), type of disability, other characteristics of disability, or other variables altogether. Indeed, as shown in Figure 1a, not all individuals reported insignificant declines in LS following disability onset. Many showed substantial and even sustained declines, while some (fewer) showed positive growth. Similarly, as shown by the grey lines in Figures 1b and

1c, there was considerable variability around the sample-average trajectories of positive affect and negative affect.

This finding is important because it highlights the need for researchers to move beyond the examination of average trends when studying people's hedonic responses to major life events. Examining only average trends can lead researchers to overlook the presence of individual differences in hedonic adaptation. Yet, knowing that such differences exist is crucial, on at least two levels. First, theoretically, it supports the notion, contrary to the set-point theory of adaptation (Brickman and Campbell, 1971), that life events are important for our understanding of long-term SWB. Indeed, if people respond differently to life events, then all happiness is not due to a genetically-determined set-point (or temperament). Second, knowing that between-person differences exist makes it imperative to investigate what might determine them—i.e., identify who is more at risk for long-term negative consequences and, conversely, what distinguishes those who maintain stable trajectories.

The Moderating Role of Age at Disability Onset

As we hypothesized based on the life course perspective, according to which the impact of major life events on developmental outcomes should vary according to when these events occur in a person's life (e.g., Elder, 1998), we found that individuals *did* differ in their responses to disability onset based on their age at onset—though in surprising directions.

Specifically, our results showed that individuals in midlife, on average, experienced a statistically-significant drop in life satisfaction the year they first reported having a disability, but then showed a tendency to return to baseline. Young adults, after

an equally significant initial drop, also showed adaptation but at a much slower rate, such that, even five years post-onset, they remained below baseline (or pre-onset levels). Lastly, individuals in old age, after an equally significant initial drop, showed no signs of adaptation and instead reported sustained lower levels of, and even a slight decline, in life satisfaction. These results largely held after controlling for type of disability, gender, educational level, income, marital status, and reliable comfort (see fixed-effect estimates from our final model in Column 1 of Table 8). Although our final model did not reveal significant changes in life satisfaction across the disability transition, it confirmed the moderation by age-at-disability-onset effect. Individuals in midlife, young adulthood, and old age were found to differ significantly in their rates of change in the years following disability onset—with midlife adults being significantly more likely to maintain stable levels of life satisfaction than the other two age groups, especially the old age group, which showed the steepest and most sustained declines.

This finding replicated Infurna and Wiest's (2016) and was further supported by the results of our analyses assessing affective well-being. Indeed, we found that all three age groups, on average, reported significant declines in positive affect immediately following disability onset, but whereas young and midlife adults showed a tendency to rebound in the years thereafter, individuals in old age showed no such tendency; in fact, they reported further declines. Conversely, we found that all three age groups experienced an increase in negative affect immediately following disability onset, but whereas midlife adults and, to a lesser extent, young adults showed a tendency to return to baseline in the years thereafter, individuals in old age showed no such tendency; in fact, they reported sustained increases in negative affect following disability onset.

Taken together, these findings indicate, contrary to Lucas' (2007) conclusion, that *old age offers no protection against the detrimental effects of disability onset on SWB*. As such, although they replicated the results of Infurna and Wiest (2016), they remain surprising. Current theories on age-differential effects of disability onset on SWB derive from the life course perspective, which predicts an opposite scenario. According to the life course perspective, because the risk of acquiring disability increases with age, acquiring disability in old age is likely to be perceived as more normative—or as an "on-time" event—and, as such, less stressful (e.g., Neugarten, 1996). Before old age, on the contrary, acquiring limitations in ADLs or mobility- and functional-related activities such as walking, standing, and lifting or carrying weights is likely to be considered as "early" and therefore indicative of premature aging (Bierman & Statland, 2010). The early nature of the experience is also likely to invite stronger upward social comparisons to similarly aged-peers (van Solinge & Henkens, 2007) as well as to make it appear more conspicuous and unusual to others (Rozario & Derienzis, 2009), thereby increasing the risk of stigmatizing attitudes and behaviors (e.g., Calsyn & Winter, 2001). Furthermore, even if newly-disabled people in young adulthood and midlife suffer neither self-denigration nor social stigma, they may have fewer social support resources than people in old age (Rook, Catalano, & Dooley, 1989). Being "off-time" necessarily means that relatively few of one's similarly-aged peers are simultaneously experiencing the same disability-related changes. Thus, even if available for support, one's peers may not know how best to provide it (Rook et al., 1989). Moreover, the strains associated with off-time events may actually disrupt existing social relationships (Neugarten & Hagenstad, 1976).

Some (or all) of these factors may account for the observed differences between people in young adulthood and those in midlife. But even so, how to explain that old age was found to be associated with the most sustained SWB declines following disability onset? One plausible explanation may lie in the presence of normative age-related effects, as lifespan developmental research has shown that SWB tends to decline with age (e.g., Mroczek & Spiro, 2005; Vogel et al., 2013). However, in their study of disability-related changes in life satisfaction, Anusic et al. (2014) demonstrated that disability onset is uniquely associated with declines in life satisfaction, over and above age-related declines in life satisfaction over time. Disabled participants were found to report lower life satisfaction even many years after disability-onset, compared to where they would have been if they had not had a disability. Positive affect and negative affect were not assessed, but there is no reason to suspect that they would yield different result.

A more likely explanation for our surprising finding may be that disability onset precipitates tertiary aging processes—that is, physical and cognitive changes that are associated with impending death (rather than with aging) (Birren and Cunningham, 1985). Evidence has been accumulating to show that psychological (including well-being) development is influenced by the dying process and that, in fact, the dying process has stronger (negative) effects on SWB than the aging process (e.g., Gerstorf et al., 2010; Palgi et al., 2010). This is in line with research postulating a systematic breakdown of psychological adaptation in the fourth age (85 years and older)—when functioning in most domains reaches its lowest limits—eventually resulting in the so-called phenomenon of "psychological mortality," characterized by loss of identity, psychological autonomy, intentionality, sense of control, and dignity (Baltes & Smith,

2003). Thus, the lack of adaptation to disability onset of people in old age may be driven by mortality-related mechanisms.

Alternatively, it is possible that societal resources (such as rehabilitation services) account for the observed age-differential effects of disability onset. Most countries, including Australia, offer rehabilitation services to individuals who acquire, or are likely to acquire, a disability. However, it is not clear to what extent such services benefit people in old age. For example, a cursory search under "rehabilitation services for disabled persons" on Google revealed that the great majority of government-sponsored rehabilitation services offer either vocational or, at best, a combination of vocational and non-vocational help. As much as this makes sense as a strategy to reduce or keep to a minimum the societal cost of unemployment among people of disability, it also implies that older adults may have fewer resources available to help them manage their everyday life and live more independently.

The Moderating Role of Type of Disability

As hypothesized, our analyses revealed that individuals *do* differ in their responses to disability onset based on the type of disability they report having. In fact, type of disability was found to moderate not only *immediate* disability-related changes in SWB, but also *long-term* adaptation. This finding is important as it further clarifies the mixed results of previous examinations of the SWB-disability onset association (including the present study's), by showing that it may *the type of disability that is acquired*, not *acquiring a disability* that results in long-lasting negative consequences for SWB.

Our hypothesis that psychological disability would be associated with the most substantial and the most sustained declines in SWB, followed by physical disability and sensory disability, however, was only partially supported. We found that individuals with psychological disability do tend to report the steepest declines in life satisfaction and positive affect and the steepest increase in negative affect the year when disability is first reported. In the years thereafter, though, their levels of life satisfaction, positive affect, and negative affect tend to bounce back, fully returning to baseline within five years of disability onset. Conversely, we found evidence that both physical disability and sensory disability are not associated with complete adaptation. Individuals with physical disability, on average, showed partial adaptation in terms of negative affect and no adaptation at all in terms of life satisfaction and positive affect. Individuals with sensory disability reported stable overall trajectories in both life satisfaction and negative affect but also a linear steady decline in positive affect starting the year of onset.

These finding are surprising on at least two levels. First, previous empirical investigations of between-person differences in SWB by type of disability (Livneh et al., 2014; Mehnert et al., 1990; Uppal, 2006) gave no indication that sensory disability would be found to result in more sustained declines in SWB than both physical and psychological disabilities. Second, the fact that physical, but not psychological disability, was found to be associated with only partial adaptation appears inconsistent with a large body of research on the impact of stigma on people with disability that suggests psychologically-disabled individuals elicit more stigmatizing responses than any other type of disability (e.g., Ditchman et al., 2013).

On the other hand, previous empirical investigations of between-person differences in SWB by type of disability were cross-sectional and, as such, could only provide information regarding *levels* of, not *level changes* (let alone rates of change) in SWB. What they revealed was that people with sensory disability tend to report *higher levels* of SWB compared to people with psychological disability and, to a lesser extent, those with physical disability. What the present study revealed is that sensory disability may well be associated with higher levels of SWB, but higher levels do not necessarily imply less negative changes (or greater adaptation). Indeed, we actually replicated cross-sectional findings. For all measures of SWB, we found that *levels* of SWB associated with sensory disability are conceptually higher than levels of SWB associated with the other two types of disability, especially psychological disability. Yet, for positive affect, we found that disability-related *changes* associated with sensory disability are more negative in the long run.

A plausible explanation for this finding may be related to the fact that sensory disability has a particularly high potential to disrupt social interaction and the sources of positive affect that it affords. For example, "speech problems that cannot be corrected" and "hearing problems that cannot be corrected" can both create barriers to verbal communication, thus hindering mutual self-disclosure, which is a major source of intimacy and intimacy-related positive emotions. Similarly, "vision impairments that cannot be corrected" deprive people with this type of disability of the capacity to see others smile—a behavior that is well-known to induce positive affect, both directly and indirectly by triggering smiling expressions (Dimberg, Thunberg, & Elmehed, 2000).

Vision-related disabilities also cause people with this type of disability to cease driving, which increases the risk of social isolation.

In a similar fashion, the present study does not run counter to the vast body of research suggesting that psychological disability elicits more stigmatizing responses than any other type of disability (e.g., Ditchman et al., 2013). Indeed, we found that psychologically-disabled individuals reported much lower levels of SWB than the other two disability groups. This finding is consistent with the results obtained by Uppal (2006) and Livneh et al. (2014) and leaves opens the possibility that stigmatizing attitudes and behaviors play a major role in shaping disabled people' SWB.

On the other hand, extending previous research, the present study revealed that psychologically-disabled people, on average, reported significantly more substantial declines in SWB immediately following disability onset than did people with physical disability *but*, unlike these latter, were able to return to baseline within 5 years of onset. This finding may be attributable to any number of reasons that require further investigation. One possibility is that people with psychological disability, unlike those with physical disability, benefit in some way from recognizing their disabled status. Our analyses revealed that psychological disability, unlike physical and sensory disabilities, was associated with declines in SWB even before disability onset. This may point to a shift in perspective, away from attributing the symptoms of psychological disability to one's personality to attributing them to a "medical condition," thus creating a sense of relief in the long-term.

Another possibility is that that people with "disfigurement or deformity" might have driven the result. A recent longitudinal study that examined the trajectories of life

satisfaction over the first 5 years following medical treatment for traumatic spinal cord injury, burns, or inter-articular fractures (Hernandez et al., 2014) found that the burn sample had more functional ability than the other two groups but lower levels of life satisfaction. The authors interpreted the results as indicating that activity limitations have a lesser impact on the well-being of people with burns than do other factors, "such as stigma and body image" (p.189). Thus, it is possible that stigma affects people with "disfigurement or deformity" more so than it affects psychologically-disabled people, explaining why the physical-disability group in our sample, unlike the psychological-disability group, never returned to baseline.

Lastly, one fruitful avenue for future research would be to determine whether comparable results would be obtained if a different set of outcome variables was considered. For example, if physical functioning-related variables were used as outcomes, people with physical disability may be found to report even steeper declines in the year surrounding disability onset and, consequently, even slower rates of adaptation in the years thereafter. If so, this would substantiate our finding that people with physical disability are the most adversely affected by disability onset.

Strengths, Limitations and Directions for Future Studies

The present study was among the firsts in the literature on the SWB-disability relation to recognize the multi-dimensional nature of SWB (see Diener et al., 2003, for a comprehensive theoretical account of SWB). Most previous investigations of disability-related changes in SWB focused on either the cognitive component of the construct (as measured by life satisfaction) or, less commonly, on its affective component, but not on both simultaneously. Moreover, Lucas (2007, Study 2), the only other study in this

literature (that we know of) to assess both *cognitive well-being* and *affective well-being*, operationalized this latter solely as psychological distress (as measured by the General Health Questionnaire; Golberg, 1992). The present study split the affective dimension of SWB into two sub-dimensions—positive affect and negative affect. This is of value because, from both a theoretical and a statistical perspective, positive affect and negative affect are not opposite ends of the same continuum but rather separate and distinct constructs, independent from one another (Diener et al., 2003).

Further, the empirical literature on disability-related changes in SWB has been dominated by studies that are either cross-sectional or short-term longitudinal investigations that do not contain pre-disability-onset observations. The present study added to this literature by providing an investigation of much-needed, and fresh, long-term prospective longitudinal data. The data being "fresh" (i.e., collected in the last decade) is important because, as several theories (e.g., the Disablement Process Model; Verbrugge & Jette, 1994) suggest, disability is a dynamic process shaped by a complex interplay of both biomedical and non-biomedical factors embedded in *historical context*. Thus, recent studies may yield significantly different findings from those conducted in the 1980s, 1990s, and even the early 2000s, due to factors related to historical timing and a more nuanced understanding of disability.

The present study also built upon and extended the small body of *prospective longitudinal* research on the relation between disability and SWB. This body of research has not only been scarce, but also inconclusive—with some studies (e.g., Pagán-Rodríguez, 2010; Powdthavee, 2009) finding that acquiring a disability tends to exert a strong but short-lived negative impact on SWB, and others (e.g., Infurna & Wiest, 2016;

Lucas, 2007) reporting evidence of long-lasting negative overall effects. The present study added to this literature by examining whether and how disability onset may differentially impact groups of individuals with differing characteristics (age at disability onset and type of disability). The results provided clarity to previous mixed finding by showing that it may be *when disability is acquired* and *the type of disability that is acquired*, not *acquiring a disability* that results in long-lasting negative consequences for SWB.

Although this study had multiple strengths, including (but not limited to) its longitudinal prospective design, pre-disability-onset data, long duration of follow-up, large sample size, and multiple measures of subjective well-being, it also had some limitations. First, as with all prospective longitudinal studies, the data were correlational. Thus, we cannot say with complete certitude that the onset of disability caused the changes in subjective well-being that we observed (because we cannot be certain that all potentially confounding variables were controlled). Future studies should consider including potentially confounding variables that were not accounted for in this study.

Second, as with most longitudinal studies, selective attrition may have added a degree of bias to our results. It is possible that individuals who stayed in the study differed in important ways from those who dropped out. Although our results cannot be accounted for by selective attrition, because they reflect within-person changes over time, it is possible that these within-person changes would not be observed in the individuals who discontinued participation. If so, our results may somewhat underestimate the effects of disability on SWB (because it is likely that participants who dropped out may have fared worse psychologically than those who continued participation). On the other hand,

we checked for duration of stay-in-study and found that, on average, participants stayed in the study for 6.94 years before and 7.94 years after the onset of disability (range: 1-15 years before and 1-14 years after). This indicates that likelihood of participation in the study did not decrease following disability onset. Further, one of the important findings of this study is that there is substantial variability in the way people respond to disability. Thus, it is likely that data from individuals who dropped out of the study may have simply increased this variability.

Third, as is always the case when relying on secondary data (i.e., pre-existing datasets), we had no control over the study design (e.g., the frequency of assessments, the content of the items assessing our variables of interest, the selection of variables to include in the surveys), and some aspects of it were not ideal. For example, the frequency of assessments may have led to biases in the results due to the loss of potentially important information. Because participants were assessed yearly, some amount of adaptation may have already occurred before the first post-onset assessment. If, for instance, a participant's disability (e.g., blindness) resulted from an accident, his or her negative affect may have increased dramatically in the weeks following the event and may have rebounded substantially by the time disability was reported for the first time. In such case, our study may have underestimated the amount of adaptation that occurred. Further research is required to examine this possibility.

Further research is also warranted to examine other potential moderators (and mediators) of the SWB-disability relation, including factors that may help explain the moderating influences of age at disability onset and type of disability. For example, future studies may benefit from focusing on societal resources (e.g., rehabilitation

services) for individuals who acquire, or are likely to acquire, a disability to examine whether they might differ by age at disability onset. It is possible that more rehabilitation services are available for individuals in young adulthood and midlife, to help them get reintegrated into society (e.g., participate in education and/or regain employment), than they are for older adults, especially those in long-term care. Given that one goal of the rehabilitation process is to improve quality of life (Rubin, Chan, & Thomas, 2003), availability of rehabilitation services may have an impact on subjective well-being and help explain age-differential effects. Similarly, future studies may want to investigate mechanisms through which type of disability was found to moderate disability-related changes in SWB. As mentioned earlier, one such candidate is stigma toward people with disability (including self-stigma and public stigma; Corrigan et al., 2003). The extent to which persons with various disabilities internalize or reject public stigma is also an important consideration. Unfortunately, we were not able to explore any of these and similar questions because the relevant information was simply not available in our dataset.

A fourth caveat of the present study, which may have biased the results, is that it did not include a control group of individuals without disability. Without comparing within-person changes in SWB of individuals with and individuals without disability, it is impossible to rule out the possibility that the observed declines in SWB in people with disability are not accounted for by normative age-related changes. Anusic et al. (2014), who did include such control group, found that disability *is* uniquely associated with declines in SWB, over and above age-related declines in SWB over time. Disabled participants were found to report lower life satisfaction even many years after disability-

onset, compared to where they would have been if they had not had a disability. We urge future researchers to replicate this finding, as well as to examine the potential effects of normative age-related changes vis-à-vis disability-related changes in positive affect and negative affect.

Relatedly, selection biases may have affected our results. Specifically, it is possible that it was only those individuals who fared the worst psychologically who reported having a disability. If so, our results may underestimate the amount of adaptation that occurs (because our study did not include disabled individuals who did not report having a disability). We urge future researchers to consider assessing the presence of disability via multiple independent sources, including self-reports, informant-reports, and official certification (if available), to make sure data from all disabled participants are included in the analyses.

Lastly, we note that our sample was representative of the Australian population. Thus, in (conceptually) replicating the finding by Lucas (2007), Anusic et al. (2014) and Infurna and Wiest (2016) that SWB is responsive to the onset of disability and that, in fact, disability onset can exert long-lasting (negative) effects on SWB, we provided further evidence that this effect is robust across countries. Nevertheless, we also note two caveats. First, Australia, from which our sample was drawn, and Germany, Switzerland, and the U.K., from which the previous studies' samples were drawn, are all OECD countries. Thus, we urge researchers to test the generalizability of this finding in samples representative of non-OECD countries' populations. Second, as discussed earlier, our study also revealed what appear to be country differences in the way people respond to disability. Therefore, we encourage future researchers to conduct cross-cultural research

to confirm the existence of these differences and explore what specific cultural factors might account for them.

Conclusion

The present study aimed to advance the current understanding of the relation between subjective well-being and disability by examining (a) the extent to which different facets of SWB change as a function of disability onset and (b) how such changes differ by age at disability onset and by type of disability. The results showed that not all three facets of subjective well-being are equally sensitive to the onset of disability. More importantly, they replicated the finding that there are substantial differences in the way people respond to the onset of disability, and showed that some of these differences are accounted for by age at disability onset and by type of disability. Specifically, individuals who acquire disability in old age and physically-disabled individuals tend to be the most adversely affected by the onset of disability, their ability to return to baseline levels of SWB being significantly impaired compared to that of individuals who acquire disability in young adulthood and midlife and that of individuals with sensory or psychological disability, respectively. Future studies should test the generalizability of these findings and investigate the mechanisms underlying the moderating effects of age at disability onset and type of disability.

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APPENDIX A

TABLES

Table 1

Inter-correlations, means, and standard deviations of the variables of interest (N = 3,795).

Variable	1	2	3	4	5	6	7	8	9
1. Age at disability onset	—								
2. Physical disability	-.001*	—							
3. Sensory disability	.21**	-.68**	—						
4. Psychological disability	-.22**	-.56**	-.22**	—					
5. Gender (woman)	-.004	.06**	-.18**	.12**	—				
6. Marital status (married)	.13**	.05**	.05**	-.13**	-.08**	—			
7. Education level (high school)	-.02**	.01*	.003	-.02**	-.11**	.14**	—		
8. Income	-.19**	.02**	.01*	-.05**	-.22**	.13**	.26**	—	
9. Reliable comfort	.08**	.06**	.02**	-.11**	.06**	.10**	.05**	.04**	—
M	50.22	62.42%	20.69%	16.89%	51.45%	68.24%	56.58%	34,254	4.27
SD	17.40							45,991	1.29
Range	16-99							0-819,503	0-6

*$p < .05$ **$p < .01$.

Table 2

Descriptive Statistics for Life Satisfaction in Relation to Disability Onset (N = 3,795).

Time to/from disability onset (years)	Number of observations	M	SD
-15	245	7.88	1.69
-14	504	7.93	1.55
-13	753	7.91	1.64
-12	1009	7.92	1.57
-11	1200	7.97	1.53
-10	1363	8.01	1.47
-9	1554	7.95	1.46
-8	1748	7.90	1.51
-7	1920	7.94	1.43
-6	2127	7.95	1.43
-5	2439	7.89	1.47
-4	2743	7.92	1.46
-3	3069	7.94	1.43
-2	3506	7.92	1.45
-1	3794	7.91	1.48
0	3794	7.73	1.58
1	3048	7.77	1.54
2	2407	7.80	1.45
3	1878	7.80	1.47
4	1377	7.76	1.47
5	1073	7.76	1.46
6	908	7.80	1.42
7	717	7.86	1.36
8	556	7.80	1.40
9	463	7.79	1.44
10	342	7.77	1.36
11	240	7.73	1.58
12	170	7.90	1.38
13	83	7.89	1.51

Note. N = 3,795 participants provided 45,030 Life Satisfaction (LS) observations for the period starting 15 years before disability onset and ending 13 years after disability onset. The average LS score was 7.87 (SD = 1.48).

Table 3

Descriptive Statistics for Positive Affect in Relation to Disability Onset (N = 3,795)

Time to/from disability onset (years)	Number of observations	M	SD
-15	235	4.10	1.05
-14	480	4.10	0.93
-13	716	4.17	0.99
-12	969	4.12	1.00
-11	1139	4.15	0.97
-10	1283	4.12	0.96
-9	1458	4.08	0.99
-8	1639	4.09	0.95
-7	1803	4.06	0.98
-6	2016	4.03	0.99
-5	2288	4.01	0.99
-4	2566	4.04	1.00
-3	2902	3.99	1.00
-2	3278	4.01	0.99
-1	3565	3.98	1.02
0	3784	3.80	1.06
1	2890	3.87	1.05
2	2274	3.86	1.05
3	1756	3.88	1.04
4	1271	3.87	1.06
5	990	3.86	1.09
6	827	3.85	1.05
7	658	3.88	1.08
8	510	3.88	1.08
9	423	3.86	1.09
10	310	3.90	1.06
11	213	3.85	1.12
12	153	3.86	1.08
13	75	3.87	1.10

Note. N = 3,795 participants provided 42,471 Positive Affect (PA) observations for the period starting 15 years before disability onset and ending 13 years after disability onset. The average PA score was 3.97 (SD = 1.02).

Table 4

Descriptive Statistics for Negative Affect in Relation to Disability Onset (N = 3,795)

Time to/from disability onset (years)	Number of observations	M	SD
-15	235	2.40	0.87
-14	479	2.30	0.80
-13	716	2.26	0.85
-12	970	2.25	0.83
-11	1138	2.31	0.86
-10	1284	2.29	0.83
-9	1456	2.32	0.85
-8	1639	2.32	0.84
-7	1801	2.31	0.83
-6	2017	2.32	0.85
-5	2288	2.32	0.84
-4	2566	2.32	0.85
-3	2903	2.33	0.85
-2	3281	2.34	0.86
-1	3567	2.37	0.89
0	3787	2.49	0.94
1	2890	2.41	0.92
2	2274	2.39	0.89
3	1755	2.38	0.91
4	1271	2.37	0.90
5	988	2.36	0.89
6	826	2.38	0.89
7	658	2.34	0.87
8	510	2.33	0.90
9	422	2.33	0.91
10	310	2.31	0.84
11	211	2.38	0.95
12	152	2.34	0.88
13	75	2.37	0.87

Note. N = 3,795 participants provided 42,469 Negative Affect (NA) observations for the period starting 15 years before disability onset and ending 13 years after disability onset. The average NA score was 2.35 (SD = 0.88).

Table 5

Changes in Life Satisfaction, Positive Affect, and Negative Affect Before and After Disability Onset

	Life Satisfaction	**Positive Affect**	**Negative Affect**
Fixed effects	Estimate (SE)	Estimate (SE)	Estimate (SE)
Intercept γ_{00}	7.78** (.02)	3.83**(.02)	2.44** (.01)
Pre, γ_{10}	-0.01* (.003)	-0.01** (.002)	-0.003 (.001)
Reaction, γ_{20}	-0.15** (.02)	-0.13** (.01)	0.10** (.01)
Post, γ_{30}	0.01* (.004)	0.002 (.003)	-0.01** (.002)
Random effects			
Intercept, u_{0i}	1.29** (.04)	0.72**(.02)	0.55** (.02)
Pre, u_{1i}	0.01** (.001)	0.003** (.0002)	0.002** (.0001)
Reaction, u_{2i}	0.35** (.03)	0.17**(.01)	0.13** (.01)
Post, u_{3i}	0.01** (.001)	0.004**(.001)	0.003** (.0003)
Covariance, u_{0i} u_{1i}	0.03** (.004)	0.02** (.002)	0.01** (.001)
Covariance, u_{0i} u_{2i}	0.20** (.03)	0.10**(.01)	0.09** (.01)
Covariance, u_{0i} u_{3i}	-0.04** (.01)	0.001 (.003)	-0.01* (.002)
Covariance, u_{1i} u_{2i}	-0.01 (.004)	-0.004 (.001)	-0.002 (.001)
Covariance, u_{1i} u_{3i}	-0.004** (.001)	-0.001 (.0004)	-0.0002 (.0003)
Covariance, u_{2i} u_{3i}	-0.0003 (.01)	-0.0001 (.002)	-0.002 (.002)
Residual variance	0.92** (.01)	0.39** (.003)	0.29** (.002)
Fit statistics			
-2 Log Likelihood	131288.5	95410.7	83101.9
AIC	131318.5	95440.7	83131.9
BIC	131412.1	95534.3	83225.5

Note: * $p < .005$ **$p < .0001$.

Table 6

The Effect of Age at Disability Onset on Changes in Life Satisfaction, Positive Affect, and Negative Affect Before and After Disability Onset

	Life Satisfaction	**Positive Affect**	**Negative Affect**
Fixed effects	Estimate (SE)	Estimate (SE)	Estimate (SE)
Intercept γ_{00}	7.64** (.03)	3.80** (.02)	2.39** (.02)
Age, γ_{01}	0.16** (.001)	0.05** (.001)	-0.14** (.001)
Age^2, γ_{02}	0.05** (.0001)	0.01 (.00004)	0.01 (.00004)
Pre, γ_{10}	-0.0003 (.004)	-0.01** (.002)	-0.01** (.002)
Pre × age, γ_{11}	0.01** (.0001)	0.01** (.0001)	-0.003* (.0001)
Pre × age^2, γ_{12}	-0.004** (.00)	-0.002** (.00)	0.002** (.00)
Reaction, γ_{20}	-0.11** (.03)	-0.12** (.02)	0.08** (.01)
Reaction × age, γ_{21}	0.01 (.001)	-0.004 (.001)	-0.02 (.001)
Reaction × age^2, γ_{22}	-0.01 (.0001)	-0.001 (.00004)	0.003 (.00003)
Post slope, γ_{30}	0.03** (.006)	0.01 (.004)	-0.02** (.003)
Post × age, γ_{31}	-0.01 (.0003)	-0.01** (.0001)	0.01** (.0001)
Post × age^2, γ_{32}	-0.01** (.0001)	-0.003* (.00)	0.002* (.00)
Random effects			
Intercept, u_{0i}	1.17** (.03)	0.78** (.03)	0.51** (.02)
Pre, u_{1i}	0.01** (.001)	0.003** (.0002)	0.002** (.0001)
Reaction, u_{2i}	0.34** (.03)	0.22** (.02)	0.15** (.01)
Post, u_{3i}	0.01** (.001)	0.01** (.001)	0.01** (.001)
Covariance, u_{0i} u_{1i}	0.03** (.004)	0.03** (.002)	0.01** (.001)
Covariance, u_{0i} u_{2i}	0.20** (.02)	-0.14** (.02)	-0.09** (.01)
Covariance, u_{0i} u_{3i}	-0.03** (.01)	-0.03** (.004)	-0.02** (.003)
Covariance, u_{1i} u_{2i}	-0.01* (.004)	-0.01** (.002)	-0.01** (.001)
Covariance, u_{1i} u_{3i}	-0.004** (.001)	-0.003** (.0004)	-0.002** (.0003)
Covariance, u_{2i} u_{3i}	-0.001 (.005)	0.02** (.003)	0.01** (.002)
Residual variance	0.92** (.01)	0.39** (.003)	0.29** (.002)
Fit statistics			
-2 Log Likelihood	130793.0	95231.8	82499.7
AIC	130839.0	95277.8	82545.7
BIC	130982.6	95421.3	82689.2

Note: * $p < .005$ **$p < .0001$.

Table 7

The Effect of Type of Disability on Changes in Life Satisfaction, Positive Affect, and Negative Affect Before and After Disability Onset

	Life Satisfaction	**Positive Affect**	**Negative Affect**
Fixed effects	Estimate (SE)	Estimate (SE)	Estimate (SE)
Intercept, γ_{00}	7.79** (.03)	3.84** (.02)	2.39** (.02)
Sensory, γ_{01}	0.34** (.05)	0.31** (.04)	-0.25** (.03)
Psychological, γ_{02}	-0.48** (.06)	-0.44** (.04)	0.58** (.03)
Physical, γ_{03}	0	0	0
Pre, γ_{10}	-0.01 (.004)	-0.01** (.002)	-0.004 (.002)
Pre × sensory, γ_{11}	0.002 (.01)	0.01 (.004)	-0.003 (.003)
Pre × psychological, γ_{12}	-0.02* (.01)	-0.01* (.01)	0.01* (.004)
Pre × physical, γ_{13}	0	0	0
Reaction, γ_{20}	-0.14** (.02)	-0.14** (.02)	0.10** (.01)
Reaction × sensory, γ_{21}	0.11* (.05)	0.11* (.03)	-0.07* (.03)
Reaction × psychological, γ_{22}	-0.16* (.05)	-0.08 (.04)	0.13** (.03)
Reaction × physical, γ_{23}	0	0	0
Post, γ_{30}	0.002 (.01)	0.002 (.004)	-0.01* (.003)
Post × sensory, γ_{31}	-0.01 (.01)	-0.03* (.01)	0.02 (.01)
Post × psychological, γ_{32}	0.08** (.01)	0.04** (.01)	-0.04** (.01)
Post × physical, γ_{33}	0	0	0
Random effects			
Intercept, u_{0i}	1.23** (.04)	0.67** (.02)	0.48** (.01)
Pre, u_{1i}	0.01** (.001)	0.003** (.0002)	0.002** (.0001)
Reaction, u_{2i}	0.34** (.03)	0.17** (.01)	0.13** (.01)
Post, u_{3i}	0.01** (.001)	0.004** (.001)	0.003** (.0003)
Covariance, u_{0i} u_{1i}	0.03** (.004)	0.02** (.002)	0.01** (.001)
Covariance, u_{0i} u_{2i}	0.18** (.03)	0.09** (.01)	0.08** (.01)
Covariance, u_{0i} u_{3i}	-0.03** (.01)	0.01 (.002)	-0.001 (.002)
Covariance, u_{1i} u_{2i}	-0.01* (.004)	-0.004* (.001)	-0.002 (.001)
Covariance, u_{1i} u_{3i}	-0.004** (.001)	-0.0003 (.0003)	-0.0001 (.0003)
Covariance, u_{2i} u_{3i}	0.00003 (.01)	0.0001 (.002)	-0.002 (.002)
Residual variance	0.92** (.007)	0.39** (.003)	0.29** (.002)
Fit statistics			
-2 Log Likelihood	131092.2	95080.1	82591.6
AIC	131138.2	95126.1	82637.6
BIC	131281.7	95269.7	82781.1

Note: Individuals affected by physical disability were used as the reference group in this model.

* $p < .005$ ** $p < .0001$.

Table 8

Changes in Life Satisfaction, Positive Affect, and Negative Affect Before and After Disability Onset as Predicted by Age at Disability Onset, Type of Disability, Socio-Demographic Characteristics and Reliable Comfort.

	Life Satisfaction	**Positive Affect**	**Negative Affect**
Fixed effects	Estimate (SE)	Estimate (SE)	Estimate (SE)
Intercept, γ_{00}	7.70** (.04)	3.75** (.03)	2.42** (.03)
Age, γ_{01}	0.11** (.001)	0.01 (.001)	-0.10** (.001)
Age^2, γ_{02}	0.06** (.0001)	0.01* (.00004)	0.002 (.00004)
Sensory, γ_{03}	0.22** (.01)	0.27** (.04)	-0.14** (.03)
Psychological, γ_{04}	-0.26** (.05)	-0.32** (.04)	0.37** (.03)
Physical, γ_{05}	0	0	0
Gender, γ_{06}	-0.01 (.04)	0.17** (.03)	-0.21** (.02)
Gender(F), γ_{07}	0	0	0
Educ., γ_{08}	0.05 (.004)	-0.04 (.03)	0.04 (.02)
Educ.(HS), γ_{09}	0	0	0
Income(0), γ_{010}	0.02 (.05)	-0.01 (.04)	0.02 (.03)
Income(1), γ_{011}	0.01 (.01)	0.01 (.04)	-0.007 (.03)
Income(2), γ_{012}	0	0	0
Married, γ_{013}	-0.38** (.04)	-0.06 (.03)	0.06* (.03)
Married(Yes), γ_{014}	0	0	0
Reliable comfort, γ_{015}	0.30** (.01)	0.01** (.01)	-0.21** (.01)
Pre, γ_{10}	0.003 (.01)	-0.01** (.004)	-0.01 (.003)
Pre × age, γ_{11}	0.01** (.0002)	0.004* (.0001)	-0.001 (.0001)
Pre × age^2, γ_{12}	-0.004** (.00)	-0.003** (.00)	0.002** (.00)
Pre × sensory, γ_{13}	0.0003 (.01)	0.01 (.004)	-0.004 (.003)
Pre × psychological, γ_{14}	-0.02* (.01)	-0.01 (.004)	0.01* (.004)
Pre × physical, γ_{15}	0	0	0
Pre × gender, γ_{16}	0.0001 (.006)	0.001 (.003)	-0.001 (.003)
Pre × gender(F), γ_{17}	0	0	0
Pre × education, γ_{18}	-0.01* (0.01)	-0.002 (.003)	-0.0004 (.003)
Pre × education(HS), γ_{19}	0	0	0
Pre × income(0), γ_{110}	0.001 (.01)	0.007 (.004)	-0.01 (.004)
Pre × income(1), γ_{111}	0.02* (.01)	0.02* (.01)	-0.001 (.004)
Pre × income(2), γ_{112}	0	0	0
Pre × married, γ_{113}	0.002 (.01)	0.002 (.004)	-0.01* (.003)
Pre × married(Yes), γ_{114}	0	0	0
Pre × reliable comfort, γ_{115}	0.01* (.002)	0.01** (.001)	-0.01** (.001)
Reaction, γ_{20}	-0.04 (.04)	-0.08* (.03)	0.07* (.02)
Reaction × age, γ_{21}	-0.01 (.001)	-0.02 (.001)	-0.003 (.001)
Reaction × age^2, γ_{22}	-0.001 (.0001)	0.003 (.00004)	-0.0003 (.00)
Reaction × sensory, γ_{23}	0.12* (.05)	0.11* (.03)	-0.06* (.03)
Reaction × psychological, γ_{24}	-0.14* (.05)	-0.08* (.04)	0.10* (.03)
Reaction × physical, γ_{25}	0	0	0

Reaction × gender, γ_{26}	-0.08* (.04)	-0.02 (.03)	-0.01 (.02)
Reaction × gender (F), γ_{27}	0	0	0
Reaction × education, γ_{28}	0.03 (.04)	-0.04 (.03)	0.002 (.02)
Reaction × education (HS), γ_{29}	0	0	0
Reaction × income(0), γ_{210}	-0.05 (.05)	-0.04 (.03)	0.004 (.03)
Reaction × income(1), γ_{211}	-0.15** (.06)	-0.09* (.04)	0.01 (.01)
Reaction × income(2), γ_{212}	0	0	0
Reaction × married, γ_{213}	-0.07 (.04)	-0.03 (.03)	0.08* (.02)
Reaction × married(Yes), γ_{214}	0	0	0
Reaction × reliable comfort, γ_{215}	0.03* (.01)	0.03* (.01)	-0.03* (.01)
Post, γ_{30}	0.02 (.01)	0.01 (.01)	-0.02** (.01)
Post × age, γ_{31}	-0.0004 (.0003)	-0.005* (.0002)	0.01* (.0002)
Post × age^2, γ_{32}	-0.01* (.00001)	-0.003* (.00)	0.002* (.00)
Post ×sensory, γ_{33}	-0.007 (.01)	-0.02* (.007)	0.01 (.006)
Post × psychological, γ_{34}	0.08** (.01)	0.04** (.01)	-0.03** (.01)
Post × physical, γ_{35}	0	0	0
Post × gender, γ_{36}	-0.01 (.01)	-0.01 (.01)	0.01 (.01)
Post × gender(F), γ_{37}	0	0	0
Post × education, γ_{38}	-0.02** (.01)	-0.01 (.006)	0.01 (.01)
Post × education (HS), γ_{39}	0	0	0
Post × income(0), γ_{310}	-0.007 (.01)	-0.004 (.01)	0.01 (.01)
Post × income(1), γ_{311}	-0.01 (.01)	0.0004 (.01)	0.004 (.01)
Post × income(2), γ_{312}	0	0	0
Post × married, γ_{313}	0.03**	0.01* (.007)	-0.01* (.01)
Post × married(Yes), γ_{314}	0	0	0
Post × reliable comfort, γ_{315}	-0.002 (.003)	-0.01* (.002)	0.01* (.002)
Random effects			
Intercept, u_{0i}	0.95** (.03)	0.57** (.02)	0.36** (.01)
Pre, u_{1i}	0.01** (.001)	0.003** (.0002)	0.002** (.0001)
Reaction, u_{2i}	0.34** (.03)	0.17** (.01)	0.12** (.01)
Post, u_{3i}	0.01** (.001)	0.004** (.0004)	0.003** (.0003)
Covariance, u_{0i} u_{1i}	0.03** (.003)	0.01** (.001)	0.01** (.001)
Covariance, u_{0i} u_{2i}	0.16** (.02)	0.08** (.01)	0.06** (.01)
Covariance, u_{0i} u_{3i}	-0.02** (.004)	0.01* (.002)	0.003* (.002)
Covariance, u_{1i} u_{2i}	-0.01* (.003)	-0.004* (.001)	-0.003* (.001)
Covariance, u_{1i} u_{3i}	-0.004** (.001)	-0.0004 (.0004)	-0.0001 (.0003)
Covariance, u_{2i} u_{3i}	0.001 (.01)	-0.0002 (.002)	-0.002 (.002)
Residual variance	0.92** (.007)	0.39** (.003)	0.29** (.002)
Fit statistics			
-2 Log Likelihood	130003.0	94340.8	81400.0
AIC	130113.0	94450.9	81510.6
BIC	130456.3	94794.1	81853.3

Note: Gender = Male. Gender(F) = Female. Education = Less than high school. Education(HS): At least high school. Income(0) = Average annual household income of AU$0. Income(1) = Average annual household income of up to AU$29,000. Income(2)= Average annual household income of AU$30,000 or more. Married = Unmarried. Married(Yes) – Married.

* $p < .005$ ** $p < .0001$.

APPENDIX B

FIGURES

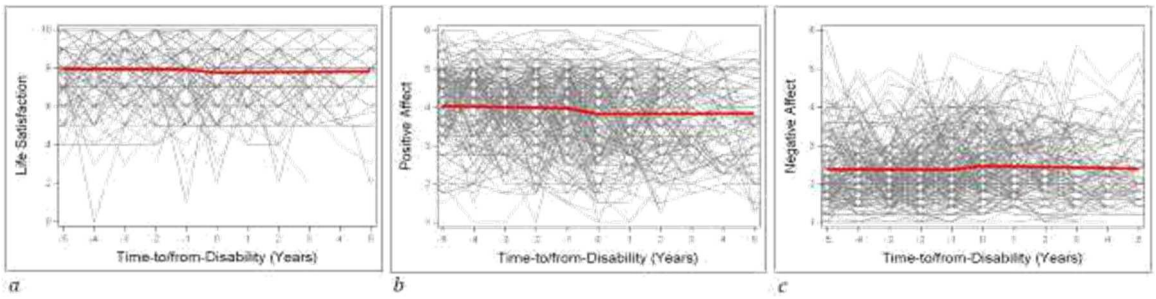

Figure 1. Model predicted changes in life satisfaction (a), positive affect (b), and negative affect (c) before and after disability onset. The red line in Figure 1a shows that life satisfaction, on average, declined in the period leading up to disability onset (Years -5 to -1), substantially dropped the year of onset (level change from Year -1 to Year 0) and then showed a tendency to bounce back (Years 1 to 5). Yet, even five years after onset, it continued to remain below its pre-onset value. The red lines in Figure 1b shows that average levels of positive affect decreased in the period preceding onset, substantially dropped the year of onset, and then stopped declining but did not rebound in the years thereafter. The red line in Figure 1c shows that negative affect, on average, remained stable in the period leading up to onset, increased significantly the year surrounding onset, and then showed a tendency to return toward baseline. However, the return (decrease) in the years following onset never brought levels of negative affect back to their pre-onset values. The grey lines depict predicted trajectories for a subset of 200 participants. They show that there were substantial between-person differences in level and rates of change in life satisfaction, positive affect, and negative affect before and after disability onset.

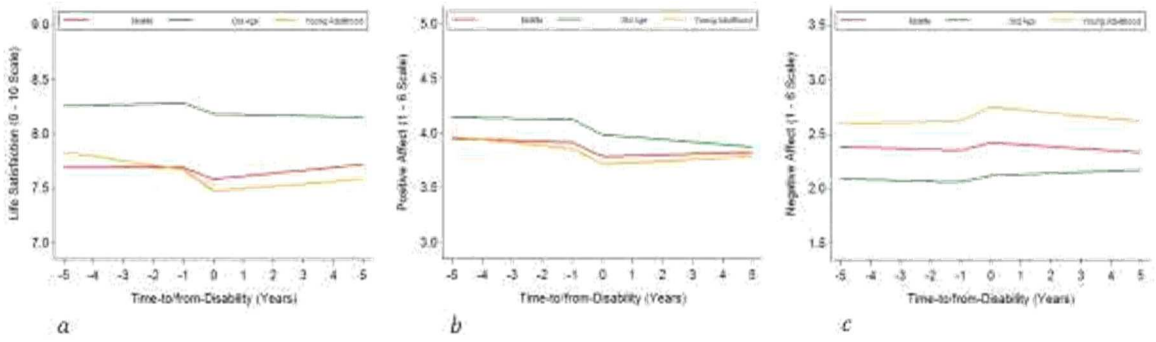

Figure 2. Graphical illustration of the moderating effect of age at disability onset on changes in life satisfaction (a), positive affect (b), and negative affect (c) before and after disability onset. The three colored lines represent young adulthood (30 years old; yellow), midlife (50 years old; red), and old age (70 years old; green). The three age groups, on average, did not differ significantly in their initial response to disability onset; they all experienced an equally significant drop in life satisfaction (a) and positive affect (b) and increase in negative affect (c) the year they first reported having disability (level change from Year -1 to Year 0). However, in the years thereafter (Years 1 to 5), individuals in midlife showed a tendency to return to pre-onset levels of life satisfaction (a), positive affect (b), and negative affect (c). Young adults showed a tendency to return toward (but not to) baseline levels of life satisfaction (a), positive affect (b), and negative affect (c). Individuals in old age showed no such tendency; instead, they reported sustained lower levels of, and even a slight decline in, life satisfaction (a) and further declines in positive affect (b) and increases in negative affect (c).

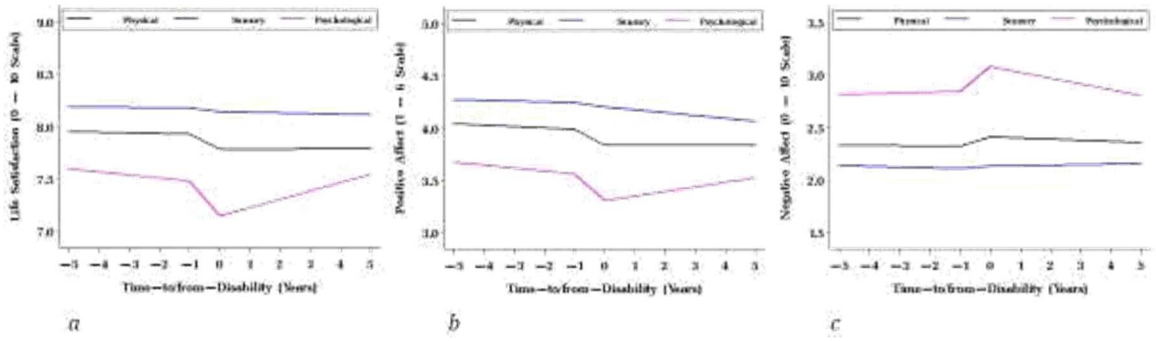

Figure 3. Graphical illustration of the moderating effect of type of disability on changes in life satisfaction (a), positive affect (b), and negative affect (c) before and after disability onset. The blue line shows that sensory disability was associated with relative stability in life satisfaction (a) and negative affect (c) across the disability transition, but also with a steady linear decline in positive affect starting the year surrounding disability onset (b). The black line shows that physically-disabled individuals, on average, reported significant declines in life satisfaction (a) and positive affect (b) and a significant increase in negative affect (c) the year surrounding disability onset (level change from Year -1 to Year 0), followed by no signs of adaptation in the years thereafter, except for negative affect (c), which showed partial adaptation. The magenta line shows that individuals with psychological disability, on average, experienced the steepest declines in life satisfaction

(a) and positive affect (b) and the steepest increase in negative affect (c) the year of onset, yet were able to recover completely (or almost completely) within 5 years of onset.